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تقدیم به منو و دشی
و به دوست که زندگیم را "مینو" نموده.

ABSTRACT

The aim of this thesis is to give a treatment of the problem of inflation in less developed countries. Such a treatment usually considers the answer to different questions to be examined, in particular: What are the causes of inflation? Why does it matter? How can it be stopped? What problems arise when action is taken to curb inflation? However, this study mainly restricts itself to answer the most basic of these questions namely, what the causes of inflation are and the result is applied to the case of Iran.

The essence of the methodological point of view of the study is that the usefulness of the model of the inflationary process that will be examined is to be judged in terms of its predictive success. This view point, although not universally accepted, seems to be the basis of most of the econometric work which has been undertaken in analyzing inflation in recent years.

The thesis has taken the following steps:

1. What inflation is and how it is measured.
2. The literature on inflation in less developed countries has been thoroughly reviewed.
3. The study has attempted to formulate a hypothesis capable of explaining the rate of change in the price level in countries whose institutional structure conform to those of less developed countries.

Several features are common to most less developed countries which have large amounts of inflation: (i) The structural weaknesses in the three sectors of the economy namely, agriculture, domestic industry, and foreign trade. Inadequate supplies of food-stuffs for the domestic market have forced agricultural prices up and governments have often responded by imposing price controls on food-stuffs, thus weakening any incentive that might exist to expand supplies. Urban workers, especially government employees, have often been able to force increases in their money wages to counteract such price rises, thus maintaining or worsening the rural-urban income differential. (ii) The central government runs a large deficit each year. (iii) The deficit is financed largely through the central bank with a resulting increase in the money supply. (iv) The deficit is partly due to the government's unwillingness to levy sufficient taxes to cover planned expenditures and partly due to the fact that the nominal value of taxes, which have been assessed sometime in the past, may not increase with the price level, whereas nominal government expenditures do.

The model consists of eleven equations and three identities which determine simultaneously the rates of change of the relative price of food, agricultural prices, industrial prices, money wages, general price level; real income, expected rate of inflation, money supply, government budget deficit, government expenditures, government revenues, balance of payments, imports, and unemployment rate. The purpose of the hypotheses then is to show how this process works, that is, how these variables are all interrelated.

4. The model is then tried on Iranian data and a multiplier and policy analysis is conducted.

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I. INTRODUCTION

Though inflation appears today to be a world-wide phenomenon, in many of the less developed countries[1] it has become more than a passing phenomenon. The long history and the way that inflation has evolved in the less developed countries have led a group of economists in these regions and elsewhere to suggest that the whole area is subject to a type of inflationary pressure peculiar to less developed countries, which require a special theory to explain it. These economists, generally known as 'structuralists',[2] maintain that the concepts of demand inflation and cost inflation current in the West are applicable only to countries already at a high stage of development. The experience of less developed countries, on the other hand, must be explained by reference to the basic weaknesses of their economies, namely their archaic institutions and the various rigidities and frictions that impede their growth. Because of their backward agriculture and consequent inelastic supply of its produce, the price of foodstuffs will inevitably rise in these countries, whenever demand for foodstuffs expands as the result of rapid growth of population, the rise of per-capita income, and increasing urbanization; in the modernizing sectors also, prices will be induced to rise, as high rewards are needed to raise the level of saving and attract capital into the required fields; and the foreign exchange rate will at the same time tend to fall because of the expansion of world demand for primary products is generally slower than the expansion of less developed countries' demand for manufactures. Furthermore, an upward pressure on costs will be exerted by rigidities in the supply of labor, energy, and transport;

---

[1] In order to simplify analysis of the problems of development it is conventional to classify these countries typified by widespread poverty under one of a number of alternative labels, such as less developed countries, underdeveloped countries, developing countries, the Third World, satellite, periphery or dependent economies. The dividing line between them and the developed countries is a purely arbitrary one, since there is no wholly objective criterion of development. But although problems of classification exist, they are not insurmountable and there is general agreement as to which countries should be included in the 'less developed' category. Nevertheless, there is in reality a high degree of diversity of economic, social and political conditions between the countries classed as less developed or as in the Third World. But they can all be categorized as 'less developed' or 'underdeveloped' given that the vast majority of their populations exist at a very low level of material welfare, and that their economic structures can be described as 'distorted' or 'disintegrated', and that their growth processes are subject to a variety of economic, technical, political and social constraints. None of the terms mentioned above is ideal, but for the sake of convenience we use the term 'less developed countries' throughout the text.

[2] The major proponents of this school include: D. Seers, "A Theory of Inflation and Growth in Underdeveloped Economies based on the Experience of Latin America," *Oxford Economic Papers*, 14, No. 2, (1962); J. Grunwald, "The Structuralist School on Price Stability and Development: The Chilean Case," in *Latin American Issues: Essays and Comments*, by A. O. Hirschman, (New York: Twentieth Century Fund, 1961); D. Seers, "Inflation and Growth: The Heart of Controversy," in

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[2](cont'd)*Inflation and Growth in Latin America*, by W. Bauer and I. Kerstenetsky, eds., (Homewood: Irwin, 1964); and R. Prebisch, "Structural Vulnerability and Inflation," in *Leading Issues in Economic Development: Studies in International Poverty*, by G. M. Meier, ed., (New York: Oxford University Press, 1970), pp. 238-41. See also O. Sunkel, "Inflation in Chile: An Unorthodox Approach," *International Economic Papers*, No. 10, (1960); and D. Felix, "An Alternative View of the Monetarist-Structuralist Controversy," in Hirschman (1961), op.cit.

and additional inflationary pressures will be generated by the oligopolistic structure of the manufacturing sector and the wholesale trade. It is from these structural factors and the resistance they oppose to development that inflation originates, not from credit expansion or budget deficits, which are themselves the inevitable consequence, rather than an independent cause, of the inflationary process.

Alongside the structuralists, a competing school of thought, monetarists,[3] suggests that the factors which cause inflation in less developed countries are similar to those causing inflation elsewhere and are primarily a matter of excess demand. Overly expansive monetary and fiscal policies are seen as the evils out of which inflation evolves.

The monetarist and structuralist models differ not only in their basic theories as to what causes inflation but also in the implications of their theories for the relationship between economic growth and inflation. According to the structuralist school of thought, the roots of inflation are in the weaknesses of the agriculture and international trade sectors and/or the income elasticity of the tax system. Structuralist theory then implies that any economic growth in the presence of these structural bottlenecks inevitably brings inflation. On the other hand, monetarist theory implies that inflation need not accompany growth; it is suggested, moreover, that due to pervasive government price controls, growth is impeded by inflation.

---

[3] R. Campos has been a major proponent of the monetarist view point in Latin America and A. Harberger has performed the classic econometric study embodying monetarist assumptions. See: R. Campos, "Two Views on Inflation in Latin America," in *Latin American Issues*, by A. O. Hirschman, ed., (New York: Twentieth Century Fund, 1961), pp. 69-73; and A. Harberger, "The Dynamics of Inflation in Chile," in *Measurement in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld*, by C. F. Christ, ed., (Stanford: Stanford University Press, 1963), pp. 219-250.

The debate between these two competing schools is not merely academic, since the policy conclusions drawn from these theories diverge sharply. At various times, the governments of less developed countries, especially in Latin America, have attempted to implement the recommendations of each side of the debate. The anti-inflation policy of the current regimes in Brazil and Chile which includes the application of fiscal and monetary restraint has been influenced by the Brazilian and Chilean proponents of monetarist theory. The land reform programs of both Frie's and Allende's governments in Chile were justified not only in terms of equity and improved agricultural performance but also in terms of the structuralist theory of inflation.

A consensus position also exists among economists which grant both structural and monetarist factors a role in the inflationary process. Cauas (1970)[4] points out that:

> Structural problems are considered to be at the root of inflation, but demand problems are clearly related to the propagation and persistence of the phenomenon.[5]

And although structuralism was originally formulated to explain inflation in Latin America, several studies have since attempted to apply this approach to the understanding of the inflationary experience in less developed countries in other areas. Yet, in spite of this widespread (although far from unanimous) acceptance that structural problems can be at the root of an ongoing inflationary process, little attempt has been made either to formulate rigorously or to test the theory. The structuralist approach lacks the theoretical underpinnings needed to compete with the monetarist hypothesis.

---

[4] J. Cauas, "Stabilization Policy: The Chilean Case," *Journal of Political Economy*, (July-August 1970).
[5] Ibid., p. 816.

After examining almost all the existing explanations and theoretical as well as empirical works on inflation in less developed countries, we came to the conclusion that the only interesting way to study the behavior of the price level in these countries was to work with a complete macroeconomic model. From an analytical point of view this is the correct way to approach the problem of inflation for it allows one to consider the most important interrelations among the main macro-variables, in contrast to the use of single equations in which all these feedbacks are disregarded.

As suggested by the title, the purpose of this thesis is to investigate the problem of inflation in Iran over the period 1959-1977. The study is an attempt towards building a macroeconomic model to study the interaction among the main economic variables. The thesis consists of eight chapters and three appendices. The purpose of the current chapter has been to define the problem, objectives and organization of the thesis.

Chapter II defines inflation and tries to discuss the problems that have to be tackled in order to measure inflation. In Chapter III we present in modern terminology the now famous controversy between structuralists and monetarists as well as other explanations of inflation in less developed countries. We then proceed to examine critically the main characteristics of these and other views on inflation in these countries.

Chapter IV is an overview of the Iranian economy. The chapter analytically describes the strategy and patterns of growth and development in Iran over the period 1959-1977. The analysis in this chapter is facilitated by the use of thirty-two tables, nearly all of which cover the entire period under study. We claim credit for the compilation of the tables, if not their originality, as all of them were compiled from basically 'raw' data.

Chapters V, VI and VII take up the main theme of the study. In these chapters, a theoretical model of inflation in less developed countries is formulated, discussed and finally empirically tested on Iranian data. Chapter V is an attempt to formulate a theoretical simultaneous equation model of inflation for Iran. To the extent that other less developed countries share the same basic economic characteristics with Iran, this model may hopefully be of some value to economic research in these areas. The model is an attempt in building a basic integrated model of inflation which embraces, at the very least, both the structuralist and monetarist ideas. The model is then used to explain the structure through which the changes in the data would be transmitted to the price level and the testable implications of the model. Chapter VI is devoted to the econometric estimation of the model discussed in Chapter V. In addition, the nature of data used in this study as well as the econometric techniques used and econometric problems encountered at the estimation stage are discussed. Chapter VII presents the use of the model for multiplier and policy analysis purposes. This chapter attempts to perform a dynamic simulation analysis of the model as well as subjecting the model to policy shock analysis. Thus Chapters VI and VII are the empirical counterparts of the theoretical Chapter V.

Finally, in addition to providing a summary, Chapter VIII lays out the major conclusions, policy implications and limitations of this study.

II. WHAT IS INFLATION AND HOW IS IT MEASURED?

A. Definition of Inflation:

The purpose of this thesis is to deal with the problem of inflation in the context of less developed countries with special reference to Iran. In this respect one has to deal with questions such as: What are the causes of inflation? Why does it matter? How can it be stopped? etc. But before dealing with such questions we must first define inflation and see what it is and how it can be measured.

Inflation has been defined in different ways by different economists, and there exists no single definition of inflation that is generally accepted. One definition which was popular in the early post Second World War years and was advocated by Lerner (1949)[1] argues that inflation is a state of affairs in which there exists excess demand for commodities in the economy as a whole. This means that the maximum level of output of home produced goods and services which is attainable in the *long-run*, given the existing productive resources, falls short of the level of spending directed towards them. The emphasis on the term 'long-run' is important for the purpose of the definition of 'excess demand'. 'Maximum attainable output' is considered on the basis that there is no excessive overtime, that machinery and equipment is shut down at the suggested intervals for maintenance, that normal stocks of raw material are being maintained, and that only fit workers for the job are employed. In the short-run, there is no need for any of these restrictions to apply. Hence the maximum output which is attainable in the long-run is a good deal less than the maximum which is attainable in the short-run, given that all the above restrictions must apply in the long-run. Therefore, it is the *potential* real GNP (long-run) rather than the *capacity* real GNP (short-run) which is relevant in connection with the definition of excess demand.

---

[1] A. P. Lerner, "The Inflationary Process", *Review of Economics and Statistics*, (August 1949), pp. 193-6.

The popular excess demand definition of inflation as being 'too much money chasing too few goods' can be criticized on two grounds. First, it is the *flow*, spending, and not the *stock*, money, which 'chases goods'. Secondly, there exists a redundancy in the phrase since excess demand means either that the desired spending is 'too much' in relation to the available goods, or (equivalently) that the available goods are 'too few' in relation to the desired spending. Therefore, to use both 'too much' and 'too few' is to say the same thing twice. An acceptable definition of excess demand inflation could be that inflation is a condition in which 'too much spending chasing the available goods'.

Paish (1971)[7] employs another definition of inflation. He argues that in order to approach the problem of inflation one should ask: "What exactly is being inflated when inflation is in progress?" The answer to this question provided by Paish is that "in inflation money incomes are being inflated relative to real potential GNP". He points out that:

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[7] F. W. Paish, *Rise and Fall of Incomes Policy*, (London: Institute of Economic Affairs, Hobart Papers, 1971).

> A better definition of inflation [than one based on prices] is that it is a condition in which money incomes are rising faster than the flow of goods and services on which to spend them -- that is to say, faster than real national income. But this definition is also not adequate, for an accelerated rise of money incomes may be accompanied for a time by an equally rapid rise of output and real income, achieved by a higher level of employment. But while the rise of incomes can continue indefinitely, and indeed is likely to accelerate as unemployment falls, the rapid rise of output can be maintained only until full employment is reached, and must then slow down to equality with the long-term trend of growth. The inflation, already implicit in the rapid rise of incomes, now comes into the open. The definition of inflation must therefore be a condition in which incomes are rising faster, not than the current rise in real national income, but than the *maintainable* rise. Apart from the effects of changes in the terms of trade and in net income from foreign investments, this is the same thing as the maintainable rise of output, or, as it is sometimes called, the rise of productive potential.[8]

There are two main differences between the above definition of inflation given by Paish and the excess demand definition of inflation. First, Paish's definition is in terms of a comparison between aggregate money income and real potential GNP rather than a comparison between aggregate spending and real potential GNP given in the excess demand definition. Secondly, Paish's definition is in terms of the levels of the variables.

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[8] Ibid., p.24. Emphasis original.

Still a third definition of inflation is given by Turvey (1951)[9]. He argues that inflation is "... a process of general price and/or wage increases starting under conditions when the general level of output can not be increased in the short run"[10] and resulting from "... competition in attempting to maintain total real income, total real expenditure and/or total output at a level which has become physically impossible or in attempting to increase any of them to a level which is physically impossible."[11]

The definition by Turvey above highlights some interesting points. It allows for either the general price level or the general level of wages to be considered as the variable which is inflated during an inflationary period. Therefore it is a broader definition of inflation than the one proposed by Paish. In addition, it restricts inflation only to conditions in which the general level of output is not able to increase, even in the short-run. This means that inflation is being restricted to situations in which *actual* real GNP has risen so far above the *potential* real GNP -- as a result of excessive overtime or the temporary recruitment of physically unfit workers for example -- that the upper limit set by real *capacity* GNP has been reached. In this respect, this definition is narrower than the one proposed by Lerner (1949). According to Lerner all situations in which the desired level of real GNP -- that is the level of spending directed towards home produced-goods and services -- exceed real potential GNP signifies inflation. However, according to Turvey(1951) not all such situations can lead to inflation since, he argues that desired real GNP must not only exceed real potential GNP, it must do so by sufficient margin in order to ensure that actual real GNP reaches the upper limit set by capacity real GNP. In other words, he argues that the excess of desired over potential real GNP must be at least as great as the excess of capacity over potential real GNP before inflation can exist.

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[9] R. Turvey, "Some Aspects of the Theory of inflation in a Closed Economy," *Economic Journal*, (September 1951), pp. 531-5.

[10] Ibid., p. 533.

[11] Ibid. p. 534-5.

In general discussion, inflation is defined as "... a process of continuously rising prices, or equivalently, of a continuously falling value of money."[12] We will follow this definition in our study with some alterations. The definition of inflation which will be used in this study is: a situation in which there is a persistent upward movement in the general level of prices, or in which there *would be* such a persistent upward movement but for the presence of direct controls over the prices.

To justify this definition some points should be mentioned. First, our definition covers not only a situation of *actual* increase in the price level (that is open inflation) but also a situation of *potential* increase (that is repressed inflation) as well. We have observed that governments faced by rapid rates of inflation have passed legislations making further price and/or wage increases illegal. Even if such legislations are passed and as a result prices cease to rise, there would still be inflation according to our definition. Because prices, although stable, *would be* rising if it would not have been for the price and/or wage freeze law. This is the case because, if there where no inflation there would be no need for the legislation.

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[12] D. W. Laidler and J. M. Parkin, "Inflation: A survey", *Economic Journal* (December 1975), p. 741.

Secondly, for inflation to exist, the upward movement, both actual and potential, in the general level of prices must be *persistent* in character. That is, if the price level is rising merely because of factors which can reasonably be expected to operate in reverse in future (that is factors which are causing prices to rise now but will cause them to fall in future), then the current upward movement of prices could not be argued to be persistent and therefore could not constitute inflation according to our definition. For example, if the general level of prices is rising because of a seasonal increase in the prices of key raw foodstuffs, or because there has been a drought condition which has led to an increase in the prices of certain important foodstuffs or agricultural raw materials or because the prices of basic commodities such as gasoline and tobacco have risen by government fiscal actions such as removal of subsidies or imposition of higher sales taxes, we might say that the observed rise in the general price level is not part of a continuing upward movement -- that is persistent -- and thus they do not constitute inflation. In the first case (key raw foodstuffs) one could argue that the seasonal increases in prices of foodstuffs will be reversed in due course as the season changes. In the second case (drought conditions), one argues that bad seasons will be followed by good ones in the future at which points the prices of agricultural raw materials and basic foodstuffs could fall. As far as the third one is concerned (government fiscal actions) the argument would be that with a change in general economic conditions the government will consider it appropriate to take fiscal actions of the opposite kind (that is to reduce taxes and increase subsidies) and therefore induce a fall in the general level of prices.

Thirdly, our definition concerning inflation as a situation characterised by a persistent upward movement of the general level of prices does not necessarily mean that it is a situation in which the movement in the general price level is *always* upward. A succession of years in which the general price level has risen, quarter by quarter without ever once falling, would undoubtedly be a period of inflation according to our definition. However, a succession of years in which the price level has risen in some quarters and fallen in others would qualify as an inflationary period as well provided that the rises have outweighed the falls; that is provided that the general direction of the movement in the general price level has been upward as a whole.

B. Measurement of Inflation

In order to measure inflation three problems have to be tackled:

1. The problem of choosing the price index which represents 'the general level of prices';
2. The problem of measuring the *extent* of the upward movement in the chosen index over any specified period of time; and
3. the problem of measuring *variations in the speed* of the upward movement in the chosen index over the specific period of time.

1. Choice of Price Index

In most advanced countries the choice of price index to represent the general price level in order to measure inflation is quite wide. They include among others:

a) The Consumer Price Index (CPI) or some of its components,
b) Wholesale Price Index (WPI) or some of its components,
c) Implicit Price Deflator of GNP,
d) The implicit deflator of some category of GNE,
e) The implicit deflator of non-farm GNP at factor cost.

In the case of less developed countries, the main possibilities are the first two; that is either CPI or WPI or some components of them. The official sources in Iran do not compile GNP deflators so that the cost of living indices and indices of wholesale prices are the only price series available.

In order to choose the appropriate index, we first list the characteristics of a price index which would be ideal for the purpose of measuring inflation.

Firstly, an ideal index is one that would relate only to commodities that are produced within the economy whose inflation is being measured. That is, if we are trying to measure the extent of inflation in Iran, we should use the price index that relates only the commodities that are produced within Iran. Therefore, a price index that covers imported, as well as domestically produced commodities is less than ideal for our purpose. It should be pointed out that when we refer to a price index which covers imported goods and services as being less than ideal we mean the price index which covers the imported commodities specifically, and not the index which covers them in the looser sense that it relates to commodities produced at home with imported materials.

Secondly, an ideal index would be comprehensive in the sense that it would relate to all goods and services produced within the economy being studied. That is an index which relates only to retail goods or to goods consumed only by wage-earners would be less than ideal.

Thirdly, an ideal index has to take proper account of improvements in the quality of various commodities covered by the index.

Fourthly, an ideal index should not be affected by price increases that are temporary, in the sense that they are likely to be reversed in the future. That is the ideal index should be unaffected by price rises caused by bad weather conditions or some kinds of government fiscal actions.

In light of the availability of data, we are restricted to choose CPI as the general price index used in our study, acknowledging at the same time our awareness of its shortcomings. That is, although the CPI fulfills the third condition reasonably well, it appears to fall short of the ideal index when considered in relation to the first two and the fourth requirements. Many imported goods are usually included in the CPI. Also, it is far from comprehensive, since the index is intended to measure only variations in the retail prices of these goods and services which account for a substantial proportion of aggregate expenditure of wage-earners. In addition, CPI covers all important raw foods and commodities whose prices are subject to significant variation through government fiscal actions. Therefore, CPI is by no means unaffected by the type of temporary price increases that we exclude in our definition of inflation. Finally, in the case of Iran, the cost of living index is usually based upon a limited sample of goods and services purchased in major urban areas and hence is not a clear representation of the consumption patterns of the majority of the Iranian population residing in small urban centers and rural areas. As a matter of fact at no time has any price index for the rural areas in Iran been constructed.[13]

Both CPI and WPI for Iran are shown in Table II-1 for the period of 1959-1977.

2. Extent of Upward Movement of Prices

Our first task in measuring inflation in Iran was to choose the consumer price index to represent the general price level. The next problem is that of determining the extent of the rise which has occured in the CPI during the period of this study, 1959-1977.

The problem of determining the extent of the rise in the consumer price index is usually approached by determining the average annual percentage increase in the CPI over the period of study, rather than by the total percentage increase. The figure obtained in this way may provide a summary of the inflationary experience of a particular period and has the advantage of being directly comparable with the corresponding figure for another period even though the two periods may be of differing length. The percentage increase in the chosen index between successive years is frequently termed the 'rate of inflation' or 'inflation rate', and the average annual percentage increase

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[13] Julian Bharier, *Economic Development in Iran, 1900-1970*, (London: Oxford University press, 1971), p. 46.

Table II-1

Consumer and Wholesale Price Indices of Iran, 1959-77

	CPI	WPI
1959	100.00	100.00
1960	110.00	103.30
1961	113.50	104.60
1962	114.30	105.90
1963	114.60	106.10
1964	119.30	111.30
1965	121.70	115.10
1966	121.30	113.80
1967	123.20	114.00
1968	124.00	114.70
1969	128.50	117.80
1970	130.50	121.20
1971	136.10	128.70
1972	144.90	136.10
1973	159.00	151.40
1974	181.80	177.10
1975	204.90	191.20
1976	228.10	208.40
1977	290.40	244.20

Source: Compiled and calculated from the information supplied in: I. M. F., *International Financial Statistics*, Yearbook 1980, pp.226-7, (See Appendix I).

is termed the 'average rate of inflation'.

The usual method of calculating the average rate of inflation for any period is the 'compound-interest' method. Under this method, it is assumed that the chosen index grew in compound-interest form over the period and then the compound-interest formula is used to calculate the rate of compound interest implied by the first and the last values of the index. Therefore, the average rate of inflation can be obtained from the following formula:

$$\dot{P}/P = 100[(P(t)/P(0))^{1/T} - 1]$$

where '$\dot{P}/P$' is the average rate of inflation and 'P(0)' and 'P(t)' refer to the first and last values of the index respectively.

Using the compound-interest formula, the average rate of inflation (CPI) for Iran in the 1959-1977 period is:

$$\dot{P}/P = 100[(290.40/100)^{1/19} - 1]$$

or

$$\dot{P}/P = 6.30\%$$

The compound-interest method suffers from the disadvantage that it is based on the first and the last values of the index and no intermediate values affect the calculation in any way. As a result the figure obtained by the compound-interest method is highly sensitive to small changes in the period during which the calculation is based.

An alternative method of calculating the average rate of inflation, which avoids the above mentioned difficulty, is the least-squares method. Under this method an equation of the form:

$$P = a\,b^{t}$$

is fitted to the observations on the chosen index, P, and a measure of time trend, t, for the period under study, by the method of least squares. The least-square estimate of 'b' (b*) is then taken to be the average ratio of increase in the chosen index over the period. Then, the average rate of inflation is obtained from:

$$\dot{P}/P = 100\ (\ b* - 1\ )$$

Unlike the compound-interest method, the least-square technique is based on all of the obsevations on the chosen index. This is because all of the observations on the index are involved in the calculation of 'b*'.

To calculate the average rate of inflation in Iran during the 1959-1977 period using the least-squares method, the log-linear version of the equation was estimated by ordinary least squares, and the result is:

$$\mathrm{Log(CPI)} = \mathrm{Log(a)} + (\mathrm{Log(b)})\ t$$

$$\begin{aligned}\mathrm{Log(CPI)} = \ &4.50 \ \ + \ \ 0.06\ t\\ &(72.59) \quad (8.17)\end{aligned}$$

Taking antilog of the estimated coefficient of 't', we get the least-squares estimate of 'b', that is:

$$\mathrm{Log(b)*} = 0.06$$

$$b* = 1.06$$

and the average rate of inflation in Iran for 1959-1977 period using the least-squares method is:

$\dot{P}/P = 100 (1.06 - 1) = 6.00\%$

3. Variation in the Speed of Upward Movement in Prices

Having chosen the consumer price index as our index of prices and having determined its extent of upward movement during the period under study, we will turn to measure the way the rise in the index was distributed over the 1959-1977 period of study.

One way of measuring the distribution of the observed rise in the consumer price index is to identify the sub-period in which the most rapid increase in the index occured, and then calculate the 'coefficient of concentration' of price increases using the following formula:[14]

Coefficient of Concentration = (Proportion of Observed Increase in Index Occuring in Sub-period) X (Proportion of Period Outside Sub-period)

If the observed increase in the index is spread perfectly evenly over the period -- that is, if the percentage increase in the index is equal to the average rate of inflation in every single year -- the coefficient will be zero because, in this case, the sub-period of most rapid price increase will coincide with the full period so that the second term in the product will be zero. However, if on the other extreme, the entire increase in the index occurs in a single year, the first term in the product will be unity, and the second term will be very close to unity which results in a value of the coefficient not appreciably different from unity. Therefore, the closer the coefficient is to unity the more concentrated is the observed increase in the index; and the closer the coefficient is to zero the more evenly spread is the observed increase.

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[14] This measure was used in an European study of inflation in the early 1960's. See *The Problem of Rising Prices*, (Paris: Organization for European Economic Co-operation, 1961), pp. 83-91.

In the case of Iran, it appears that the prices rose more rapidly after the 1973 oil euphoria. Therefore, the coefficient of concentration for the sub-period of 1973-1977 is calculated as follows:

$$C = (0.83/1.904) \times (15/19) = 0.34$$

which means that one-third of the price inflation has concentrated in the period following the oil price explosion of 1973.

To summarize, the definition of inflation used in this study is: a situation in which there is a persistent upward movement in the general level of prices, or in which there would be such a persistent upward movement but for the presence of direct control over the prices.

The average rate of inflation in Iran for the 1959-1977 period is 6.30 percent (annually) using the 'compound-interest' method and 6.00 percent using the 'least-squares' method; and the coefficient of concentration for the 1973-1977 sub-period is 34 percent.

III. REVIEW OF LITERATURE ON INFLATION IN LESS DEVELOPED COUNTRIES

A less developed economy is usually characterized as a distorted, disintegrated structure, subject to a number of economic, technological, sociological and political constraints, in which, in the absence of basic structural reforms, growth and development can not be expected to proceed smoothly. By 'distortion' or 'disintegration' we mean that the less developed economies and societies are dualistic structures in the broadest sense of that term. That is, subsistence production and production for the market co-exist, old and new technologies are used side by side, and new social classes have arisen alongside the traditional strata. Development strategies have in general been based on consumer-goods import substituting industrialization which involves a heavy reliance on foreign capital and technology which usually is capital intensive. These countries also have been characterized by the neglect of their rural sector, particularly the supply of foodstuffs for the domestic market and by an unequal distribution of income which is made even more unequal by the type of economic policies that are pursued.

The inadequate supplies of foodstuffs for the domestic market have caused the prices to increase and the response by the government has been the imposition of price controls on foodstuffs which have resulted in weakening of any incentive that could have existed to expand supplies of foodstuffs. Urban workers and especially the government employees have often been able to force increases in their money wages in order to counteract such price increases. This practice has maintained or even worsened the rural-urban income differentials. Low incomes in the rural areas and the lack of job opportunities have further led to an increase in movement of labor into the over-expanded urban areas.

During the 1970's, less developed countries became subject to severe inflationary pressures. Such pressures were both internal -- resulting largely from the development policies being pursued -- and external to the less developed economies -- inflationary pressures within the world economy, manifesting themselves largely through rising import prices. It can be argued that inflation during the 1950's and 1960's was not a general phenomenon in less developed countries. With the exception of a number of Latin American countries (Argentina, Brazil, and Chile), the price level showed a high degree of stability in less developed countries. It is often argued that these countries should be prepared to tolerate or encourage higher rates of inflation in order to promote capital accumulation and growth. Thirwall (1974)[13] argues that in studying the less developed countries outside Latin America, "... the impression remains that capital accumulation and employment growth may have

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[13] A. P. Thirwall, *Inflation, Saving and Growth in Developing Economies*, (London: Macmillan, 1974).

Table III-1

Percentage increases in the Consumer Prices of Developed and Less Developed Countries, 1960-1979

	Annual Average*		Changes from preceding year				
	1960-9	1970-5	1975	1976	1977	1978	1979
D.C.**	2.7	6.9	11.1	8.3	8.4	7.2	9.1
L.D.C.:***							
1)Oil Exporting	1.7	8.9	18.6	15.9	15.1	10.7	10.8
2)Non-oil Exporting	11.0	15.6	24.8	26.0	27.5	24.6	29.3
-Africa	4.1	8.5	15.6	15.5	19.8	15.8	16.5
-Asia	5.3	10.8	10.2	-1.0	8.0	5.8	9.4
-Europe	8.2	12.8	18.4	15.1	19.7	25.1	33.0
-Mid-East	3.3	11.2	20.9	18.2	20.8	23.6	30.3
-Latin Am.	19.9	22.8	40.6	55.3	47.4	40.6	46.5

*Calculated by the author using compound annual rates of change.
**Developed industrialized countries.
***Less developed countries.
Source: I.M.F., *International Financial Statistics*, Yearbook 1980, pp. 58-61.

been sacrificed for the sake of financial stability."[16]

Table (III-1) shows that although Latin American countries still experience the highest rates of price increase, there has been a significant increase in other less developed countries as well. In general, the average rate of inflation in less developed countries throughout 1960-1979 period has been significantly higher than the average rate for the industrialized countries.

A. Inflation and Growth

It has often been argued that inflation could be used as a mechanism which has the ability of promoting growth. It is argued specifically that inflation would increase savings through the redistribution of income towards profits (because of the time lag involved between price rises and the increase in wages and other costs) assuming that profit receivers have a higher marginal propensity to save than the wage earners. Inflation, therefore, would allocate more resources into the process of growth by the stimulating effect that it has on the level of economic activity and, indirectly, would create the condition for greater price flexibility as it would permit necessary relative price changes in conditions of downward rigidity of prices.[17] In addition, it has been argued that government investment is necessary for the elimination of bottlenecks that constrain growth. If the only way to carry out these investments is by government deficit spending, the conditions that would be created by it would lead to inflation. Attached to this idea is the concept of self-liquidating inflation. Inflation which creates capital for investment is self-liquidating in so far as the new capital produces a stream of consumer goods that eventually dampens or eliminates the inflationary pressures; although a question arises here as to how quickly the new capital becomes productive and how productive it is.[18] In this sense, inflation is considered as a form of taxation which transfers resources to the government. At this point we should be more careful of assuming a straight-forward relationship between inflation and government deficit financing. Myrdal (1968)[19] argues that the size of the deficit does not provide a scale in order to measure the effects of the budget on inflation since:

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[16] Ibid., p. xii.
[17] R. Thorp, "Inflation and the Financing of Economic Development", in *Financing Development in Latin America*, by K. Griffin, ed., (London: Macmillan, 1971), pp. 195-6.

> i) Expenditures, taxes and loans vary and have varying effects on the timing, direction, and size of demand and supply in different domestic markets and also on all of these factors in relation to foreign transactions; simple aggregation is therefore misplaced.
> ii) The effects of the budget can not be separated from the effects of a number of other policies that do not appear in the budget; this would imply illegitimate isolation.
> iii) The budget covers only a small part of the whole economy, and therefore many important areas

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[18] A. W. Lewis, *Development Planning*, (London: Allen and Unwin, 1966), pp. 130-38.

[19] G. Myrdal, *Asian Drama: An Inquiry into the Poverty of Nations*, (London: Twentieth Century Fund, Penguin, 1968).

are left in the dark.[20]

Empirical evidence concerning the relationship between inflation and growth is inconclusive, although there have been some suggestions that high rates of inflation, that is 10 percent or more annually, have a detrimental effect on the rates of growth.[21]

B. Structuralist and Monetarist Explanations of Inflation in Less Developed Countries

Two main groups of economists loosely labelled structuralists and monetarists have largely been involved in the debate over the causes and consequences of inflation in less developed countries.[22] Each of these two groups represent broadly a certain type of approach to the problem of inflation in particular, and to economic development in general. Although the terms 'structuralist' and 'monetarist' are merely convenient labels and do not necessarily indicate a coherent school of thought, there are important differences between them as to the cause of inflation and its possible cures, especially with respect to the need for, and efficiency of, orthodox stabilization programs.

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[20] Ibid., p.2025.

[21] Thorp (1971), op. cit., p. 199.

[22] Part of this section draws on: C. H. Kirkpatric and F. I. Nixson, "The Origins of Inflation in Less Developed Countries: A Selective Review," in *Inflation in Open Economies*, by G. Zis and M. Parkin, eds., (Manchester: Manchester University Press, 1976), pp. 126-174.

1. *The Structuralist Analysis of Inflation*

According to structuralists, inflation is inevitable in an economy which is attempting to grow rapidly in the presence of structural bottlenecks which are defined by Thorp (1971) as "... certain fundamental facets of the economic, institutional and socio-political structure of the country which in one way or another inhibit expansion."[23] They argue that inflation in less developed countries usually accompanies the transition of these economies from an outward-oriented export-based economy to an inward-oriented domestic-market based economy in which the import substituting industrialization plays a key role. The fundamental changes in the socio-economic structure that are required by such economic development can not be brought about by the price mechanism operating within very imperfect market structures characterized by limited resource mobility, and thus shortages and disequilibria appear.

The main body of structuralist literature is concerned with the identification and analysis of these alleged bottlenecks, or in Sunkel's (1960)[24] terminology the basic or structural inflationary pressures. The key bottlenecks are generally taken to be: (i) the inelastic supply of foodstuffs, (ii) the foreign exchange constraint, and (iii) the budget constraint.[25]

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[23] Thorp (1971), op.cit., p. 185.
[24] O. Sunkel, "Inflation in Chile: An Unorthodox Approach", in *International Economic Papers*, No. 10, (1960).

With respect to the agricultural sector bottleneck, it is argued that urbanization and rising incomes have led to a rapidly increasing demand for food which the agricultural sector is unable to meet. The reason for poor supply response of the agricultural sector is argued to be the existence of the structural constraints within that sector. More specifically, the structuralists argue that the agricultural sector in less developed countries is dominated either by large non-capitalist latifundia which are not profit maximizers, or by minifundia operating almost at a subsistence level and hardly integrated into market economy. This inelastic supply, then, constitutes a structural inflationary factor. As Sunkel (1960) argues:

> ... the stagnation of global agricultural production can not be attributed to market, demand and/or price conditions, but must be due to factors inherent in the institutional and economic structure of the main part of the agricultural sector itself.[26]

The foreign exchange bottleneck arises, according to structuralists, because the rate of growth of foreign exchange receipts is not sufficient to meet rapidly rising import demands generated by accelerated development efforts, rapid population growth and the industrialization effort which takes place in an environment of technological limitations, structural imbalances and imperfect factor mobility.[27] Import shortages and rising import prices trigger off cumulative price rises. The structurally induced balance of payments difficulties eventually force the less developed countries to devalue their currencies and this, in turn, adds to domestic inflationary pressures, especially when the elasticity of demand for imports is very low.

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[25] These bottlenecks have been clearly described by D. Felix, "An Alternative View of the Monetarist-Structuralist Controversy," in *Latin American Issues*, by A. O. Hirschman, ed., (New York: Twentieth Century Fund, 1961), pp. 81-94.

[26] Sunkel (1960), op.cit., p. 115.

At this point, it is useful to contrast the foreign exchange gap hypothesis with the monetary theory of the balance of payments. According to the foreign exchange gap analysis, the balance of payments deficit is a source of inflationary pressure, while according to the monetary theory of the balance of payments, a deficit reduces the domestic money supply and thus reduces pressure on prices. In the former, the elimination of the deficit encourages economic development and alleviates inflationary pressures; in the latter case, the move from a deficit to a surplus on the balance of payments is accompanied by rising prices.

The budget deficit bottleneck, identified by some structuralists but not all,[28] argues for the lack of internal financial resources. The structuralists argue that development efforts increase the scope of necessary government involvement in the economy, especially in social and physical infrastructure facilities. However, government revenues rarely expand rapidly enough to meet the growth of government expenditures. Tax structures are regressive in less developed countries and collecting bureaucracies are sometimes inefficient and corrupt. The insufficiency of government revenues is usually overcome by recourse to deficit financing which has inflationary consequences.

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[27] A full presentation of the foreign exchange bottleneck is given by: D. Seers, "A Theory of Inflation and Growth in Undedeveloped Countries based on the Experience of Latin America," *Oxford Economic Papers*, (June 1962).

[28] For example Olivera (1964) disagrees with the inclusion of this bottleneck. See J. H. G. Olivera, "On Structural Inflation and Latin American Structuralism," *Oxford Economic Papers*, (November 1964), pp. 266-331.

Myrdal (1968)[29] argues that other bottlenecks such as lack of adequate transport facilities, repair facilities, credit facilities, imported raw materials, fuel and electricity are important in giving rise to inflationary pressures.

Other than the basic inflationary pressures Sunkel (1960)[30] identifies exogenous inflationary pressures. These include upward movements in the prices of imported goods and services and major increases in public expenditure arising out of natural disasters or political pressures. Finally, structuralists argue for cumulative pressures which are induced by inflation itself. These pressures are identified as an increasing function of the rate and extent of inflation and they include expectations, the negative impact of inflation on productivity including distortions introduced into the price system by price controls and the lack of export incentives.

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[29] Myrdal (1968), op.cit., pp. 1928-29.
[30] Sunkel (1960), op.cit.

For the various structural constraints to give rise to price increases, which in turn lead to a rapid and continuous increase in the price level, there must be an effective transmission or propagation mechanism which allows for the various inflationary pressures to reveal themselves.[31] If different groups in the economy did not attempt to maintain their relative positions in the presence of inflation, the chances of an inflationary spiral being generated would be reduced and the increase in prices would lead to a redistribution of income.

One of the major components of the propagation mechanism is the budget deficit which leads to an increase in the supply of money. The government expenditures can not be easily reduced and the government revenues do not easily increase. Therefore, to the structuralists, money is a factor which allows the inflationary pressure to manifest itself and become cumulative -- it is a symptom of the structural rigidities that give rise to inflation, rather than the cause of inflation itself. An increase in money supply is therefore considered as a necessary condition for the rise in prices but it is not a sufficient condition.

2. The Monetarist Analysis of Inflation

An alternative analysis of inflation in less developed countries is that of monetarists who argue that:

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[31] Ibid., pp. 111-12.

> Inflation originates in and is maintained by expansionist monetary and fiscal policies, comprising government deficit spending (coupled with the operation of inefficient state enterprises and uneconomic pricing policies), expansionist credit policies and the expansionary exchange operations of central bank.[32]

They argue that the rate of inflation will be reduced and the concomitant distortions in the economy eliminated by curbing the excess demand through monetary and fiscal policies, control of wage increases and the elimination of over-valued exchange rates. Monetarists believe that the dominant source of growth in the money supply is central bank lending and that the most effective way of reducing the rate of growth of the money supply is to block off this source of growth. This can be done either by eliminating the government deficits which the borrowings are used to finance or by substituting private sector borrowing for public sector borrowing. Given the primitive state of less developed countries' capital markets, the former seems to be the only real alternative.

It should be mentioned that monetarists in the context of structuralist-monetarist controversy of inflation in less developed countries, unlike those identified as monetarists in the United States, do not take a position on the question of whether money supply growth to finance government spending has a greater impact on nominal income than money supply growth to finance central bank loans to the public. Therefore, they are not necessarily claiming that, in theory, only money matters. In this respect they are distinguished from U.S. monetarists.

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[32] Kirkpatrick and Nixson (1976), op. cit., p. 136.

Monetarists do not deny the existence of constraints but they argue that they are not structural or autonomous in nature. Rather, they result from the price and exchange rate distortions which are generated by the inflation itself and government attempts to reduce the rate of price increase. For example, Campos (1961)[33] points out that the alleged structural food supply bottleneck is in fact the result of the frequent administrative control of food prices; the result of the attempts by the governments to protect urban consumers and avoid growing pressures for wage increases. This interference in the operation of market forces has a disincentive effect on food producers, but it is a distortion induced by the administrative controls and is not inherent in the structure of land ownership. High prices for some items such as food are necessary to induce an adequate supply, but this should happen within the context of the overall control of the money supply and the re-allocation of resources through the market mechanism. High prices for such items are offset by low prices for others, and as a result inflationary pressures are not generated. Furthermore, monetarists argue that the slow growth of exports is policy-induced rather than structurally induced. They argue that exchange rates are typically over-valued and development efforts are emphasizing import substituting industrialization (inward-looking) rather than outward-looking policies which are aimed at maximizing traditional exports and developing new lines.

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[33] R. de O. Campos, "Two Views on Inflation in Latin America," in Hirschman (1961), op.cit., p. 112.

Monetarists, therefore, accept the existence of constraints and bottlenecks but reverse the causal relationship. They argue that the bottlenecks in the economy that inhibit growth will be eliminated when inflation is brought under control. The majority of monetarists recognize the 'social priority of development' but argue that stable and sustained growth can only be achieved in an environment of monetary stability.[34] On the other hand, structuralists are often accused of favouring inflation as a means of accelerating growth but in general this is not the case. Rather, they are concerned with the problem of making stability compatible with development but argue that price stability can only be achieved through economic growth, which is a long-run process. Short-run stabilization policies, although effective in reducing the rate of inflation, impose heavy social and economic costs and retard the processes of structural change which is necessary for longer-term growth and development they argue. In effect, structuralists prefer inflation to stagnation, that is inflation is regarded by them as the lesser of two evils.

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[34] R. de O. Campos, *Reflections on Latin American Development*, (Austin: University of Texas Press, 1967).

To summarize, two competing schools of thought, monetarism and structuralism, have developed in order to explain the causes and consequences of inflation in less developed countries. Monetarists suggest that the factors which cause inflation in less developed countries are similar to those causing inflation elsewhere and are primarily a matter of excess demand. Structuralists, on the other hand, stress that there are factors peculiar to less developed countries' institutional structure which explain why these regions are predisposed to inflation. More specifically, according to the structuralist view, the relative backwardness of agriculture in many of less developed countries' (particularly Latin American areas) inflationary economies explain the propensity toward inflation in these economies. They argue that inflation results because agricultural prices rise over time, and since other prices do not fall, the general price level increases.

C. Empirical Evidence

There have been a number of attempts to test empirically the economic relationship assumed by one side or the other in the debate over the causes of inflation in less developed countries. In these studies two kinds of evidence have been used. First, each theory imposes different restrictions on the long-run relationship between the rate of growth of real output and the rate of inflation. In the structuralist's view, curbing inflation leads to unemployment and economic stagnation. Monetarists agree that a slowing of growth is the immediate effect of an anti-inflation policy but they argue that, in the long run, neither a higher growth rate nor a higher rate of employment can be bought through higher inflation rates. Intertemporal and cross-section studies have been performed to determine which set of restrictions is consistent with the historical evidence.

Secondly, the two models have been used to relate the incidence of inflation to the presence of factors which may be considered structuralist or monetarist. Several empirical studies using the monetarist method have been performed. Others, especially those focusing on structuralist model, do not use statistical testing procedures. A few of these studies are reviewed in this section.

1. Empirical Studies of Structural Inflation

Maynard (1961)[38] uses the argument that it has been the Latin American economies with lagging agricultural development that have experienced rapid inflation in order to support his conclusion on the importance of excess demand conditions in agriculture.

Several other studies have investigated in more detail the inflationary experience of a single country in an attempt to find a positive correlation between the strength of structuralist factors and the pace of inflation. Mueller (1965)[34] examines the impact of various structuralist factors on the inflationary process in Mexico. These factors are bottlenecks in the agriculture, foreign trade, and public sectors. The seriousness of agricultural bottlenecks is calculated by estimating the excess demand for food while those in foreign trade sector are represented by various terms of trade measures as well as by the growth in real imports relative to growth in GNP. Finally, the two variables used by Mueller to reflect the intensity of the public sector bottleneck are the public sector deficit as a percentage of GNP and the percentage of public expenditure allocated to investment over the two decade period of the study. Then, these are used to evaluate the hypothesis, cited by some structuralists, that the tax system in Latin America is income inelastic so that deficits and the concomitant inflationary pressures arise inevitably with economic development.

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[38] G. Maynard, "Inflation and Growth: Some Lessons to be Drawn from Latin American Experience," *Oxford Economic Papers*, (June 1961).

These hypotheses are tested by looking at the inflationary experience in Mexico in two periods, the decades of 1940's and 1950's. The relationship between inflation and economic growth seems to undergo a shift over these years.

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[34] M. W. Mueller, "Structural Inflation and the Mexican Experiences," *Yale Economic Essays*, (Spring 1965).

> For every year but one (1941), the last decade contains those years in which a given rate of economic growth was accomplished by a lower rate of price increase. On this evidence the decade of the fifties suffered less from structural inflation than did that of forties.[37]

The agricultural bottleneck is less in the latter decade in Mueller's study and, while the deficit as a percentage of GNP did not change significantly over the two decades, public investment as a percentage of public expenditure grew in the 1950's. Since Mexico suffered more inflation during the 1940's than the 1950's these two findings can support a structuralist interpretation. On the other hand, the capacity to import and various terms of trade measures worsened over the period. Thus, the results are left to be inconclusive, although they do support the structuralist argument based on agricultural difficulties.

Edel (1969)[38] investigates the inflationary experience in much of Latin America on a country by country basis. He first, following Seers (1964),[39] divides Latin American economies into those with adequate and those with inadequate growth in agriculture. An adequate growth rate is defined as being sufficient, given income elasticities of demand and growth in real income, to keep the price of food constant. On this basis, Edel shows that, in Mexico, Brazil, and Venezuela, food production is shown to be adequate over the period of 1953-62, while in Argentina, Chile, Colombia, Peru, and Uruguay food production falls beneath the required level. He then examines the turning points in the inflationary spirals of the countries in these two groups and finds evidence supporting the structural model.

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[37] Ibid., p. 157.

[38] M. Edel, *Food Supply and Inflation in Latin America*, (New York: Praeger, 1969).

[39] D. Seers, "Normal Growth and Distortions: Some Techniques of Structural Analysis," *Oxford Economic Papers*, XVI, No. 1, (1964), pp. 78-104.

Kahil (1973)[40] in his study of Brazil studies four alleged structural bottlenecks, namely the agricultural sector bottleneck, the inadequate mobility of capital, the external sector bottleneck and the effect of rapid urbanization (increased private and public demand for goods and services and increased cost of supplying food to the urban areas). He argues that structural weaknesses did not play a significant role in the evolution of the price level over the period of 1946-1963. To Kahil, the aggravation of these structural weaknesses was more an effect than cause of inflation. Price rises were caused by large and growing public deficits, a too rapid expansion of bank credit in the early period and unnecessarily large and increasingly frequent increases in legal minimum wages at a later stage. Kahil argues that these factors interacted in such a way that it was impossible to distinguish cause from effect, and thus the basic causes of inflation appeared to have become mere parts of structuralist propagation mechanism.[41]

Kahil then qualifies his monetarist conclusion by arguing that the factors ultimately responsible for inflation were political rather than economic. The two major policy aims of the 1950's in Brazil were rapid industralization and the winning of the allegiance of the urban masses, at the same time serving the interests of other politically important groups such as big industrialists and bankers. Inflation was thus the outcome of the attempt by the state to promote growth and development and grant privileges, although temporary and illusory, to mutually antagonistic groups or classes.

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[40] R. Kahil, *Inflation and Economic Development in Brazil, 1946-1963*, (Oxford: Clarendon Press, 1973).
[41] Ibid., pp. 329-331.

Finally Argy's (1970)[42] study provides an econometric analysis of structuralism which, unlike others, is specified in a form suitable for hypothesis testing. He attempted to assess the contribution of structural elements to inflation using cross section data for 22 countries for the period 1958-1965. He constructs a variety of indices to test four structural hypothesis -- the demand shift hypothesis (shifts in the composition of demand, as distinct from generalized excess demand, cause upward shifts of the price level), the export instability hypothesis (fluctuations in export earnings will tend to create a long-term upward movement in the price level), the agricultural bottleneck hypothesis and the foreign exchange bottleneck (both were discussed above). He added two additional variables to some of the regressions; the government deficit rate and the rates of change in money supply.

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[42] V. Argy, "Structural Inflation in Developing Countries," *Oxford Economic Papers*, (March 1970).

Argy concludes that the results for the structuralists variables are poor, except for the fact that there is a slight tendency for countries where food prices have risen most relative to the cost of living to have higher rates of inflation. However, the monetary variables perform well. "In every case the addition of a monetary variable to structuralist variables improved substantially the results."[43]

Argy's study clearly shows, and the author himself admits, the difficulties involved in testing the structuralist position. It is very difficult to specify correctly and construct indicators which adequately encompass the essence of the alleged structuralist constraints. For example, in order to test the foreign exchange bottleneck, Argy uses (i) the average annual percentage change in the terms of trade and (ii) the average import ratio (imports over GDP). But neither of these measures indicates the capacity to import and thus are not a satisfactory test of the balance of payments constraints. In addition, there is likely to be significant multicollinearity between the independent variables used in the regression analysis.

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[43] Ibid., p. 83.

2. Empirical Studies of Money and Inflation

There are a few studies trying to formulate a monertarist model of inflation in the context of less developed economies. Earlier work by Harberger (1963)[44] and more recently studies by Diz (1970),[45] Vogel (1974),[46] Dutton(1971)[47] and Aghevli and Khan (1977)[48] are attempts in this direction. Studies by Harberger, Diz and Vogel are limited to a model of inflation with only one equation. Thus, they have treated the stock of money as exogenous variable and have used the reduced form equation for the price level in a simple macro-economic model as the single equation.

Harberger (1963) has used the rate of inflation as dependent variable and regresses it upon the percentage change in money supply during the present and preceding year and the percentage change in real income during the present year. Changes in velocity caused by expected changes in the cost of holding idle balances are allowed by introducing past changes in the rate of inflation as an additional independent variable. Harberger also attempts to allow for the influence of structuralist factors by including a wage variable and uses wage changes as an additional independent variable in the regression equation. Harberger's study of Chilean inflation covers the period 1939-58, and his approach is basically a monetarist one by testing the hypothesis of a stable demand function for real balances by regressing the rate of inflation on the independent variables. The empirical results obtained by Harberger appear to support the monetarist interpretation of the causes of inflation in Chile with the sign , magnitude and significance of each coefficient agreeing with Harberger's expectation. However, Harberger does not adopt a strict monetarist position which his result seem to support and argues that:

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[44] A. C. Harberger, "The Dynamics of Inflation in Chile," in *Measurement in Economics: Studies in Mathematical Economics and Econometrics*, by C. F. Christ, ed., (Stanford: Stanford University Press 1963).

[45] A.C. Diz, "Money and Prices in Argentina, 1935-62," in *Varieties of Monetary Experience*, by D. Meiselman, ed., (Chicago: Chicago University Press, 1970).

[46] R. C. Vogel, "The Dynamics of Inflation in Latin America, 1950-1969," *American Economic Review*, 64, (1974).

[47] D. S. Dutton, "A model of Self Generating Inflation," *Journal of Money, Credit, and Banking*, (May 1971), pp. 345-62.

[48] B. B. Aghevli and M. S. Khan, "Inflationary Finance and the Dynamics of Inflation: Indonesia, 1951-72," *American Economic Review*, 67, (1977).

> The results suggest that one of the major roles of the wage variable was indeed as a transmitter of inflation from one period to the next, responding to the monetary expansion of the past period and including monetary expansion in the subsequent period. The wage variable does not significantly alter the prediction ... and in this sense one does not need it ... . The wage variable does not add significantly to the variation in the rate of inflation explained by monetary factors: in this sense too ... one does not need it. But none of these denies that if wage changes had tended in the period to be unaccompanied by monetary expansion, prices would have nonetheless responded. Nor does it deny that prior wage rises were an important factor in inducing monetary expansion during the period. It only says that during this period monetary expansions were typically great enough to finance prior wage changes, and that on the top of this, monetary expansions had independent variations, which also influenced the price level in much the same way as if they had been accompanied by wage

changes.[4]

The studies by Diz (1971) and Vogel (1974) are extensions of the basic Harberger model. Diz uses Harberger's model for the study of causes of inflation in Argentina covering the period 1935-62. Two dependent variables are used, wholesale price and cost of living indexes. The independent variables are: money supply with two definitions, one including and the other excluding saving and time deposits; real income; an index of nominal wages; the official exchange rate; and a measure of price expectations. In Diz's regression results, the money supply, real income, and expectation coefficients are statistically significant and exhibit the expected signs. The wage coefficients are not significant and the exchange rate coefficients, although significant, suggest a highly inelastic response to changes in the exchange rate. Diz's conclusion is that changes in the money supply have a substantial impact on the rate of inflation as an evidence in support of the monetarist analysis of inflation.

Vogel (1974) has extended the Harberger model to 16 Latin American economies and his study covers the period 1950-69. The dependent variable used is the consumer price index, and the independent variables are money supply (currency plus demand deposits), real income (nominal GNP deflated by the consumer price index), and finally past changes in the rate of inflation as a proxy for the expected cost of holding real balances. Structural variables such as wage changes and exchange rate changes are not included in the model. His results based on the pooled data exhibit a high level of overall explanatory power, and the estimated coefficients of the explanatory variables have the expected signs and are statistically significant, with the exception of the lagged changes in inflation rate variable. The results of the individual country regressions were less favourable, and reveal considerable differences between countries. Vogel concludes that:

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[4] Harberger (1963), op. cit., pp. 246-47.

> The most important result of the present study ... is that a purely monetarist model with no structuralist variables, reveals little heterogeneity among Latin American countries, in spite of their extreme diversity. The substantial differences in rates of inflation among these countries can not under the present model be attributed to structural differences, but must rather be attributed primarily to differences in the behavior of the money supply.[60]

Vogel, however, misinterprets the structuralist position when he implies the structuralists argue that inflation can be explained by 'structural differences', independently from changes in the monetary environment.

The studies by Harberger, Diz and Vogel indicate that money supply may not be exogenous in every less developed economy and the importance of the role of money supply suggest further research for its determination. Studies by Dutton, and Aghevli and Khan are attempts to incorporate an endogenous money supply and formulate a hypothesis to comprise the whole system.

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[60] Vogel (1974), op. cit., p. 113.

Dutton's (1971) model consists of four equations determining the rate of change of prices, the rate of monetary expansion, the rate of growth of the monetary base, and the nominal deficit. The money stock used in Dutton's model is defined as currency plus demand deposits. The monetary base includes currency held by public plus bank reserves. Government deficit is expenditures minus tax receipts of the central government, and the price level is measured by consumer price index. Expected rate of price changes has been used as an additional explanatory variable in the price equation.

The period of study covered by Dutton is the second quarter of 1958 through the fourth quarter of 1966, and the model has been tried on Argentine data. He concludes that the system of four equations does reasonably well in describing the inflationary process in Argentina for the period covered, with sign, magnitude and significance of each coefficient in the model agreeing with Dutton's expectations. The result of Dutton's study on the effects of the rate of monetary expansion on the rate of price level change imply that an increase in the money supply increases the price level after some time lag, and that after about two years over 95 percent of the effect of the money supply increase on prices has been felt.[51]

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[51] Dutton (1971), op. cit., pp. 255-58.

Aghevli and Khan (1977) have developed a model of inflationary process for Indonesia. Their approach is that inflation in Indonesia is basically a monetary phenomenon, and that the monetary expansion itself is linked to the rate of inflation through the government budget. Aghevli-Khan model, like that of Dutton, uses four relationships. The model consists of four first-order differential equations determining the rates of change of prices, real government expenditures, nominal tax revenues and money supply. Real value of government expenditures has been defined as a constant fraction of real income. Desired level of nominal taxes is explained by being a constant fraction of nominal income.

In Dutton's model price level, money stock, deficit and monetary base were endogenous variables, while in Aghevli-Khan model, price level, real government expenditures, nominal tax revenues and money supply constitute endogenous variables. In Aghevli-Khan model, the deficit is decomposed into two variables (expenditure and tax revenues) each of which is separately taken as a dependent variable in the model, while in Dutton's model the deficit is not disaggragated. However, both models use the same definition of money and use basically the same predetermined variables, although in Aghevli-Khan model the lag structure is estimated, while in Dutton's model lags are imposed arbitrarily.

Aghevli-Khan model is estimated using Indonesian data covering period 1951 through 1972. All the estimated parameters in the model have the expected signs and are significantly different from zero at 5 percent level. Aghevli-Khan conclude that the resultant budget deficit increases the money supply which, in turn, induces further inflationary process. Hence, the model seems to explain the Indonesian inflation quite well.[52]

In summary, the conclusion that monetary variables have a high correlation with the rate of inflation should be treated with caution and monetarists can be criticized on this ground. Evidence of correlation fails to provide an understanding of the underlying causal relationships that exist between the structural constraints, monetary expansion and inflation. Structuralists can be criticized on the grounds that they have often devoted insufficient attention to the nature of the propagation mechanism in general and the expansion of money supply in particular which is necessary, other things being equal, for the manifestation of the spiralling price rises.

In addition, the various studies described above illustrate the difficulties that arise in attempting to assess empirically the relative importance of the structural and monetary factors in inflation in less developed countries. Harberger, Diz and Vogel studies show how very different conclusions about the monetarist-structuralist controversy can be reached from essentially similar findings. In Kahil's study, an initial monetarist interpretation can in fact be shown to be consistent with the structural analysis of inflation. The fundamental problem of distinguishing cause from effect, as distinct from discovering evidence of correlation, has limited the usefulness of existing quantitative investigations. At the very least it can be argued that an examination of the empirical studies that have so far been undertaken neither discredits nor disproves the structural analysis of the causes of inflation in less developed countries.

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[52] Aghevli and Khan (1977), op. cit., pp. 395-97.

IV. AN OVERVIEW OF THE IRANIAN ECONOMY, 1959-1977

Except for its first few years, during the period covered by this study (1959-1977), the Iranian economy enjoyed high rates of growth. All the conventional indices of growth demonstrate this fact. According to Table IV-1, in terms of constant 1959 prices, GDP rose by an average of 5.42 percent per year during the first half of 1960's, by 11.63 percent in the second half of 1960's, by 10.78 percent between 1970 and 1975, and finally it declined by 2.07 percent between 1976 and 1977. Between 1959 and 1977, GDP grew from 299.10 billion of rials to 1,344.56 billions of rials at 1959 constant prices. During this period, all aspects of the economy from the composition and uses of output to the allocation of inputs, were in a state of transition. This rapid transformation is not likely to result from natural economic forces alone, but special external factors and government policy actions must also be present. In the case of Iran, all of these factors played their role.

The basis of this expansion has been oil and the peculiar features of this resource that provided the opportunities and at the same time shaped the limitations of the Iranian economic development. Growing international demand for oil assisted the rapid growth of the economy by providing supply of foreign exchange to be used for financing an increasing amount of imports. In addition, the

Table IV-1

Gross Domestic Product
1959-1977

	GDP at current prices b. Rls (1)	GDP cte.1959 prices b. Rls (2)	Growth rate of (2) % (3)	GDP per capita cte. 1959 prices 1000 of Rls. (4)	Growth rate of (4) % (5)
1959	299.1	299.10		14.29	
1960	328.4	318.16	6.37	14.78	3.43
1961	346.0	328.46	3.24	14.84	0.41
1962	367.0	349.16	6.30	15.33	3.30
1963	394.2	372.10	6.57	15.88	3.59
1964	436.1	389.27	4.61	16.17	1.83
1965	478.2	433.98	11.49	17.49	8.16
1966	522.6	481.04	10.84	18.83	7.66
1967	577.1	535.15	11.25	20.35	8.07
1968	658.8	601.81	12.46	22.22	9.19
1969	741.9	674.70	12.11	24.19	8.86
1970	841.5	760.71	12.75	26.54	9.71
1971	1014.3	856.46	12.59	28.76	8.36
1972	1268.4	1001.18	16.90	32.77	13.94
1973	1868.6	1118.59	11.73	35.74	9.06
1974	3137.0	1205.80	7.80	37.52	4.98
1975	3561.1	1240.67	2.89	37.57	0.13
1976	4606.6	1372.93	10.66	40.50	7.80
1977	5393.3	1344.56	-2.07	39.23	-3.14

Columns 2 & 4 were calculated by the author using figures provided by the source for GDP at constant 1975 prices and population series (see Appendix I).

Source: I.M.F., *International Financial Statistics*, Yearbook 1980, pp. 228-29.

economy also received major stimulus from the public sector's massive current and developmental expenditures. These public sector expenditures -- undertaken generally in the context of specific development plans -- served to modernize and expand considerably the productive capacity of the country as well as to upgrade the administrative machinery of the country. Meanwhile, in order to counter the inflationary pressures resulting from such expansionary fiscal operations, the government had frequent recourse to a host of restrictive policy actions.

In this chapter we present a general overview of the Iranian economic conditions and policies over the 1959-1977 period. The major structural changes that have taken place in the economy and the nature of policies pursued to achieve growth are both emphasised.

A. Development Plans, Strategy and Growth of the Economy

Since the early 1930's Iran has pursued an almost consistent development strategy which was essentially aimed at modernizing the country under a system of mixed economy with the main emphasis on industrialization. The degree of government encouragrment to the private sector in a mixed economic system which is characterized by extensive government ownership, control and regulation fluctuated in different periods, but changes were relatively small. The development of agriculture and related activities received very little attention compared to that of manufacturing, and little attention was given throughout to employment.

From 1930 to the Allied occupation of Iran in 1941, the economy underwent considerable transformation which was brought about by the adoption of western laws, and the development of Tehran and other provincial towns as growth centers. A significant public investment program also took place that included the creation of ports and shipping, construction of trans-Iranian railway system, and general improvement of basic infra-structural facilities such as roads, communications and power and water. Also, the government took an active part in the introduction of large-scale manufacturing industry. However, little resulted from efforts to develop the agricultural sector.[53]

The Allied occupation of Iran during the Second World War produced major political and economic changes. The loss of government authority together with material shortages caused by the war and occupation put a virtual halt to the industrialization programs. Large military expenditures by the Allied Forces in Iran served to intensify the inflationary pressures which had already gained momentum during the late 1930's. Between 1941 and 1944, the wholesale price index increased by more than 200 percent.[54]

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[53] A detailed survey and analysis of economic development in Iran in this period is given by Julian Bharier, *Economic Development in Iran: 1900-1970*, (London: Oxford University Press, 1971).

[54] Farhad Daftari, "Development Planning in Iran: A Historical Survey," *Iranian Studies*, XVI, No.4, (1973), p. 197.

Following the Allied withdrawal in 1945, a fresh start was made to reconstruct the economy. The first systematic attempt came in 1949, when Iran's First Seven Year Development Plan (1949-1955) was formally inaugurated. However, the events leading to the nationalization of the oil industry in 1951 and the Anglo-Iranian dispute that followed brought the First Plan to a halt due to lack of funds and the foreign exchange crisis.[55] With the resumption of oil exports in 1955, the government called off the First Plan and initiated the Second Seven Year Development Plan (1955-1962).

The implementation of the Second Plan was soon accompanied by an unprecedented inflationary boom and balance of payments difficulties which was blamed on a race to increase all categories of expenditure by various public agencies and an indiscriminate expansionary fiscal policy. By 1960, as inflation gathered strength and foreign exchange reserves became depleted, the Iranian government turned to the International Monetary Fund and other international agencies for help, but none of these potential lenders was prepared to help unless the government adopted an economic stabilization program.[56] The stabilization program was implemented in the fall of 1960 and called for drastic reduction in the rate of expansion of internal borrowing, non-essential imports and current government expenditures.[57] This stabilization campaign was carried out so successfully by the newly instituted Central Bank of Iran and the Ministry of Finance that the economy was led into about three years of almost complete stagnation. It took a new plan and a large bonus payment in foreign exchange from a new oil concessionaire to bring the economy back to life again.

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[55] See N. S. Fatemi, *Oil Diplomacy, Powder Keg in Iran*, (New York: Whittier Books, 1954); and A. Sampson *The Seven Sisters*, (London: Bantam Books, 1975), chapter 7.

[56] H. Mahdavy, "The coming crisis in Iran," *Foreign Affairs*, 44, (1965-1966), p. 135.

In order to pursue the development strategy of the country in a less disruptive manner than in the 1950's, economic planning was made more comprehensive in the 1960's. During the Third Development Plan (1962-1967) -- that was constructed with the help of Harvard Advisory Group[58] -- and the Fourth Development Plan (1968-1972), the traditional strategy of modernization and industrialization in a mixed economy was pursued more vigorously and systematically. More emphasis than in the past was put on achieving a higher rate of growth and investments. GDP growth rates of 6 and 9 percent in real terms were to be achieved in the Third and Fourth Plans respectively, compared with 5 percent during the fifties.[39] More emphasis than before was also placed on maintaining price stability and equilibrium in the balance of payments.[40]

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[57] The text of stabilization program, together with the two revisions, is given in Central Bank of Iran, *Bulletin*, 1, No.5, (1963), pp. 23-33. See also A. A. Poorhomayoon, "The Monetary and Foreign Exchange Policies of Bank Markazi Iran," Central Bank of Iran, *Bulletin*, 2, No. 7, (1963), pp. 3-10.

[58] The Harvard Advisory Group (HAG) was organized and directed by Professor Edward S. Mason of Harvard, assisted by David E. Bell and Gustav F. Papanek of the Project's home office in Cambridge. Members of HAG worked as advisors in a bureau of 15 to 20 Iranian economists, headed initially by Khodadad Farmanfarmaian.

The growth and pattern of output during the 1960's went a long way toward the achievement of the main objective of the plans. The growth of the economy accelerated substantially; GDP annual growth rate in real terms averaged 10 percent during the Third Plan and 13 percent for the Fourth Plan (see Tables IV-1 above and IV-4 below), both well above the originally stipulated growth rates of 6 and 9 percent respectively. The public sector expanded its share in investment to about 55 percent, compared with about 38 percent during the 1950's. Sectoral allocation of Public sector investment respected the Plans priorities with investment in industry representing 36.1 percent of total investment in the two Plans, in housing 7.6 percent, in transport 23 percent, in services 24 percent and in agriculture 9.4 percent.[41] The 1960 decade also witnessed a period of price stability, with the wholesale price and consumer price indices at about 2.5 and 3 percent per year over 1960-1970 period (Table IV-2). By 1970, however, signs of an increasing rate of inflation were becoming apparent, a phenomenon that steadily intensified as oil revenues

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[39] Daftari (1973), op. cit.,pp. 191 & 206.

[40] Plan and Budget Organization of Iran, *Outline of the Third Plan*, pp. 35-40, and idem., *Fourth National Development Plan*, pp. 53-60.

[41] Central Bank of Iran, *Annual Reports and Balance Sheet*, (1968), pp. 112 and 228-29 and idem., (1973), p.158.

Table IV-2

Consumer and Wholesale Price Indices of Iran, 1959-77

	CPI	% Change	WPI	% Change
1959	100.0		100.0	
1960	110.0	10.00	103.3	3.30
1961	113.5	3.18	104.6	1.26
1962	114.3	0.71	105.9	1.24
1963	114.6	0.26	106.1	0.19
1964	119.3	4.10	113.3	4.90
1965	121.7	2.01	115.1	3.41
1966	121.3	-0.33	113.8	-1.13
1967	123.2	1.57	114.0	0.18
1968	124.0	0.65	114.7	0.62
1969	128.5	3.63	117.8	2.70
1970	130.5	1.56	121.2	2.89
1971	136.1	4.29	128.7	6.19
1972	144.9	6.47	136.1	5.75
1973	159.0	9.73	151.4	11.24
1974	181.8	14.34	177.1	16.98
1975	204.9	12.71	191.2	7.96
1976	228.1	11.32	208.4	9.00
1977	290.4	27.31	244.2	17.18

Source: Table II-1 above.

gradually picked up in the early 1970's and culminated in the oil price explosion of late 1973. It should be noted that the figures for Iranian inflation were officially produced. As Graham (1979) observes: "... they [inflation figures] were doctored to produce a publicly acceptable norm. Published prices tended to reflect what they ought to have been, rather than what they were."[62]

The Fourth Plan terminated in 1972. Soon afterwards the government initiated the Fifth Development Plan (1973-1978), by far the most comprehensive and ambitious development effort ever launched in Iran. In view of Iran's enhanced foreign exchange position, resulting from the oil price hike of December 1973, the expenditures and targets of the Fifth Plan were substantially revised in 1974.[63] The basic objectives of the Plan, apart from traditional goals of rapid industrialization and of growth, were to put more emphasis on agricultural growth, to reduce the existent supply bottlenecks, and to improve the standard of living of lower income groups. To achieve the latter objective, Plan stipulated a nationwide health program, low income housing projects, expansion of free education, and increased subsidies for basic foodstuffs.

Economic development during the Fifth Plan, however, did not achieve the basic objectives of the Plan. The annual average growth rate of GDP was envisaged by the revised plan to rise by 25.9 percent at constant prices.[44] According to Tables IV-1 and IV-4, the annual average growth rate of GDP at constant prices rose by only 4.8 percent, well below the target rate as well as that achieved during the Third and Fourth Plans with the highest single growth rate of 11.73 percent recorded for the year 1973. However, substantial structural changes, and surprisingly enough, moderate rates of inflation were achieved. According to Table IV-2 above, wholesale price and consumer price indices rose at an annual average rate of 12.5 and 15 percent, respectively, over the period covered by the Fifth Plan. This achievement in part was due to increased imports, large investments, and the adoption of highly restrictive policies and controls by government.

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[62] R. Graham, *Iran: The Illusion of Power*, (London: Croom Helm Ltd., 1978), p. 91.

[63] A detailed description of the main objectives of the revised Fifth Plan is given in Echo of Iran, *Iran Almanac and Book of Facts*, (Tehran: 1975), pp. 367-371.

Having outlined the major economic events in Iran, we now turn to a quantitative assessment of economic conditions and policies in Iran.

B. Patterns of Growth

Prior to the 1973 oil euphoria and the increase in the Iranian oil revenues, the growth rate of the economy was rapid. During the period of the Third and Fourth Development Plans -- 1962 to 1972 -- the real output of the country's productive resources (GDP) increased at an average annual rate of over 10 percent in constant 1959 prices (Table IV-1 above). This rapid growth was not only due to increased oil production. During 1962-1972, the GDP of the non-oil sector increased from 287.89 to 792.80 billions of rials in constant 1959 prices, that is at an annual average growth rate of 8.5 percent (Table IV-3). During the post oil price explosion of 1973 and resulting boom in oil revenues, however, economic growth did not accelerate as rapidly as was expected. During the 1973-1977 period, oil and non-oil GDP growth rates in real terms averaged 4.8 and 5.8 percent, respectively (Table IV-4). Economic growth, also, resulted in a more sophisticated economic structure, and if GDP per capita can be considered as an index of standard of living, one can claim substantial improvement in it in spite of the fast growing population. According to Tables IV-1 and IV-4, per-capita GDP rose from 14,290 rials in 1959 to 32,770 in 1972 and further to 39,230 rials in 1977 at constant 1959 rials; that is with an annual average growth rate of almost 6 percent.

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[44] Ibid. p. 369.

The rapid growth in total output reflects high growth rates for the main producing sectors except agricultural sector. According to Table IV-5, with the exception of agriculture, all sectors have enjoyed high growth rates over the period under review. Thus, for the 19 year period 1959-1977, industrial sector (which includes mining and quarrying, manufacturing, water and power) has grown at an average rate of almost 10 percent in real terms annually. Service sector (which includes transportation and

Table IV-3

Gross Domestic Product and its Composition
1959-1977
(Billions of 1959 Rials)

	GDP	Agriculture*	Oil & Gas	Industry **	construction	Services ***	GDP non-oil
1959	299.10	85.40	47.10	32.00	13.30	121.30	252.00
1960	318.16	88.07	49.89	35.17	14.34	130.69	268.27
1961	328.46	88.00	52.69	36.64	13.96	137.17	275.77
1962	349.16	92.19	61.27	42.15	13.13	140.42	287.89
1963	372.10	92.88	66.74	46.91	14.73	150.84	305.36
1964	389.27	98.73	64.98	49.27	15.71	160.58	324.29
1965	433.98	108.90	75.05	56.81	21.33	171.89	358.93
1966	481.04	112.02	88.46	66.73	21.17	192.66	392.58
1967	535.15	119.06	104.51	77.34	26.34	207.90	430.64
1968	601.81	127.52	118.85	88.79	30.24	236.41	482.96
1969	674.70	134.41	137.97	101.58	35.10	205.64	536.73
1970	760.71	145.18	165.70	114.90	37.06	297.87	595.01
1971	856.46	145.49	233.81	130.04	43.06	304.06	622.65
1972	1001.18	159.29	208.38	149.02	46.10	438.39	792.80
1973	1118.59	140.32	351.69	151.75	47.23	427.60	766.90
1974	1205.80	116.58	554.12	130.15	37.75	367.20	651.68
1975	1240.67	116.33	479.32	142.67	72.57	429.78	761.35
1976	1372.93	127.05	502.82	158.05	106.37	478.64	870.11
1977	1344.56	120.91	413.34	168.50	123.36	518.45	931.22

* Includes: forestry and fisheries.

** Includes: Mining & quarrying, manufacturing, water and power.

*** Includes: Transportation & communication; domestic trade; banking, insurance & brokerage; public services; ownership occupied dwelling and private services.

Source: Calculated by the author from information supplied in (see Appendix I):
1) I.M.F., *International Financial Statistics*, Yearbook 1980; and
2) Central Bank of Iran, *National Income of Iran: 1959-1972*, p. 21; and
3) Central Bank of Iran, *Annual Reports and Balance Sheet*, 1356, (1977) p. 92.

Table IV-4

Rates of Growth of GDP (at constant 1959 prices)

	Average annual Rates (percent)				
	1959-62	1963-67	1968-72	1973-77	1959-77
GDP	5.62	10.13	13.22	4.82	8.80
Non-oil GDP	4.93	9.62	10.14	5.78	7.87
GDP per capita	2.68	6.98	9.99	2.44	5.85

Sourcs: Tables IV-1 and IV-3.

Table IV-5

Sectoral Growth Rates of GDP at constant 1959 Prices

	Average annual Rates (percent)				
	1959-62	1963-67	1968-72	1973-77	1959-77
Agriculture*	2.13	6.56	2.24	-3.19	2.21
Oil and Gas	9.19	12.52	27.04	7.79	14.70
Industry**	10.10	13.70	11.42	3.20	9.93
Construction	2.85	16.18	9.47	33.68	15.24
Services***	5.62	9.44	13.66	5.65	8.92

* Includes: forestry and fisheries

** Includes: mining and quarring, manufacturing, water and power

*** Includes: transportation and communication; banking, insurance and brokerage; public services; ownership occupied dwelling; and private services.

Source: Table IV-3.

communication; domestic trade; banking, insurance, and brokerage; public services; private services; and ownership occupied dwelling) have enjoyed a growth rate of almost 9 percent annually in constant 1959 prices. However, the growth rates of these two sectors decreased substantially during the Fifth Plan period (1973-1977) recording an annual average rate of growth of almost 3.2 percent in industrial sector and 5.6 percent in services sector in real terms due partly to high rates of inflation prevalent in this period. Agricultural sector (including forestry and fisheries) has recorded a growth rate of only 2 percent during 1959-1977 period. During the Fifth Plan period, this sector showed a negative rate of growth of -3.2 percent per year in real terms.

The significance of the poor performance of agriculture has many aspects. Agricultural sector in Iran has not received the attention it should have from public investment.[65] Emphasis has been relatively on large industrial projects to the neglect of agriculture. The Plan and Budget Organization of Iran have devoted only a small portion of their funds to the agricultural sector. The fund allocated to agriculture in the First Plan was so small and projects were so limited that, apparently, it had very little effect on traditional farming.[66] In the Second Plan, the government directed most of its capital outlay to irrigation structures and multi-purpose projects for water and power for urban areas.‘’ The benefits to rural people, as a whole, from irrigation have been rather minor.‘‘ The type of development expenditure that characterized the Third Plan hoped to achieve a 13 percent rise in national wheat and barley output at a cost of about $14 million for producing and distributing certified seed of improved varieties. On the whole, the planners decided to place more emphasis upon minor innovations such as improved seed, chemical fertilizer and improved farming practices which collectively make up the scientific revolution in agriculture. Although the sum of 16.5 million rials (36.7 percent of total funds allocated for agriculture) was allocated for irrigation, mainly to complete Dez and Sepid Rud dams, there was a major shift in water resources development policy toward small systems instead of large dams.‘’

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[65] See Section G below.

[66] H. Motamen, "Development Planning in Iran," *Middle East Economic Papers*, (1956).

That was what planners planned to do; but in practice, when the government suddenly embarked on a nation-wide land reform just before the start of the Third Plan, the effect was to co-opt all the resources of the sector -- the administrative energies and the development funds -- for this program and to make everyone forget the programs

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‘’Plan and Budget Organization of Iran, *Outline of the Third Plan*, p. 3.

‘‘G. B. Baldwin, *Planning and Development in Iran*, (Baltimore: Johns Hopkins University Press, 1966), p. 50-53.

‘’Plan and Budget Organization of Iran, *Outline of the Third Plan*, pp. 69-72.

planners had planned.[70]

The Fourth Plan began when the nation-wide land reform had been underway for five years. At first, the agricultural sector was to absorb 13.5 percent of the total allocation of funds, but this was later reduced in absolute terms by 21 percent.[71] An average annual increase of 5 percent in real terms in agricultural products was envisaged in the course of the Plan.[72] This target was to be achieved, as it was stated in the Plan, by "... maximum utilization of land already under cultivation, the cultivation of virgin lands, the establishment of large agricultural units and joint-stock farming companies, the expansion of animal husbandry, the wider application of extension services and employment of modern techniques."[73] Apparently in the Fourth Plan, a new approach was made to the development of the agricultural sector: intensive farming on a strictly commercial basis and the attainment of the pre-supposed production target were to be met by the establishment of large agricultural units and the encouragement of the private sector to embark on agricultural ventures. However, the plan failed to meet its growth target of 5 percent for agriculture, and instead, 2.24 percent growth rate at constant prices was attained (Table IV-5). Apparently, one reason was that the Plan had placed much hope on large-scale agriculture units to contribute to total agricultural production but, in the event, their contribution was negligible. According to an estimate by International Labor Office made at the end of the Fourth Plan period, agri-business companies and farm corporations were cultivating 110,000 hectares, or 1.5 percent of the total cultivated area; they employed 0.3 percent of the agricultural labor force and produced less than 2 percent of total agricultural output.[74] Another reason, possibly, was that these two forms of agricultural organization received the largest proportion per hectare of available grants and credits at the expense of small cultivators. The small farmers neither received their fair share of the resources nor the needed attention and services.[75]

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[70] Baldwin (1966), op. cit. p. 70.

[71] Central Bank of Iran, *Annual Reports and Balance Sheet*, (1972), p. 76.

[72] Plan and Budget Organization of Iran, *Fourth National Development Plan*, p. 40.

[73] Ibid, pp. 41-42.

The Fifth Plan began when agriculture, traditionally a source of foreign exchange earnings, changed its position and the country became the net importer of agricultural products. The ever-increasing gap between supply and demand for agricultural products, together with the need to increase farmer's income, led the policy makers to lay more stress on agriculture in the Fifth Plan. The agriculture budget increased substantially to reach 121 billion rials in the original Plan, four times the amount allocated to agriculture in the Fourth Plan, and was later increased to 239.6 billion rials in the revised Plan.’‘ The growth target for this sector was set at 7 percent in real terms in the revised Plan’’ -- three times more than its normal growth rate during the Fourth Plan (Table IV-5). Even though the seven percent growth target was very modest when compared with the 18 percent growth target set for industrial sector, nevertheless, it was an ambitious goal. With more funds available in the Fifth Plan, a wise agricultural policy was a key factor to the success of the agricultural sector. With the completion of the three stages of the land reform and clarification of the legal status of persons engaged in agricultural activities, the government was in a proper position to undertake adequate policies for rationalization and modernization of the farming system. In this respect the Fifth Plan did not undergo major changes. The major policies were based on the belief that small and scattered farmers by themselves can not quickly achieve the large increases in production. Therefore, the government continued with the policies of the Fourth Plan, that is the policy of establishing large agricultural units such as

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[74] ILO, *Employment and Income Policies for Iran*, (Geneva: ILO, 1973), p. 40.

[75] For a detailed account of commercial farming in Iran during the Fourth and Fifth Plans see: J. Frievalds, "Farm Corporations in Iran," *Middle East Economic Journal*, XXVI, No. 2 (1972); M. Rabbani, "A Cost-Benefit Analysis of Dez Multi-purpose Project," *Tahghighat-i-Eghtesadi*, (Autumn 1971), pp. 135-65.; F. R. C. Bagley, "A Bright Future After Oil: Dams and Agro-business industry in Khozestan," *Middle East Journal*, (winter 1976); and F. Halliday, *Iran: Dictatorship and Development*, (London: Markham, Penguin Books, 1979), chapter 5.

’‘Echo of Iran, *Iran Almanac and Book of Facts*, (Tehran: 1975), pp. 367-68.
’’Ibid, p. 369.

agri-businesses, farm corporations and meat and dairy complexes in order to take advantage of the so-called economies of scale. Further to the approval of the new regulations regarding the provision of credit and subsidy for the agricultural activities, the government decided to encourage the agricultural production through subsidization for mechanized large-scale agriculture in the country.

None of the above measures helped the agricultural sector to meet its target rates of growth, and even worse it grew, as was mentioned above, at a negative rate during the period of the Plan. It should be added that close to 60 percent of the population are living in the rural areas, and the measures taken during the Plan and the negative growth of the agricultural sector kept much of the agricultural population poor. The result was a large migration to the cities that caused urban congestion and placed severe strain on the capacity of the cities to provide basic services. In addition, the agricultural sector was unable to meet the growing domestic demand for food products. This imbalance generated strong inflationary pressure despite the government efforts to subsidize and to increase the volume of imports of foodstuffs.

Growth of the industrial sector (which includes mining and quarrying, manufacturing, water and power) accelerated sharply in the sixties, reflecting accelerated investment which was encouraged by generous incentives and by continued import substituting industrialization under heavy protection. The domestic manufacturing sector, which accounts for over two-thirds of industrial output, includes simple activities such as food processing, textiles and footwear manufacture and sophisticated operations such as the assembly of various consumer and capital goods, and the production of steel and petrochemicals. Relative to the size of the domestic demand, however, the size of the industrial sector is small, and a variety of both consumer and capital goods must be imported.

The main form of industrial expansion took the form of import substitution and in addition the growth of small establishments were impressive. Whereas the development of modern industry in Iran accompanied the transition from labor-intensive units to more capital-intensive ones, industrial expansion took on the form of disproportionate expansion in the small units up to early 1970's. With access to new capital through higher oil revenues, industry, during the Fifth Plan period, chose capital-intensive solutions attracted by the benefits of high technology in production, although an International Labor Office report on Iran in 1973 warned against the overemphasis on capital-intensive industries:

> An employment strategy dictates that the Iranian authorities should now aim at a better balance between capital-intensive and labor-intensive industries. In order to avoid tipping the scales in the wrong direction, thereby hindering the attainment of the employment objective, ... new capital-intensive projects should be limited to fields of indisputable economic priority(such as

mining) ...'[78]

Theoretically, this could have been a logical decision in that better and more efficient techniques, if employed, would produce a more cost-effective operation. But, the fact is that choosing the more capital-intensive solution was measured against the norms of western industrialized countries and not Iran.

The government policies on the choice of industry and its techniques affected the type of technology selected. The significant investments done by the government during the Second and Third Plans were for the establishment of a few capital-intensive sugar mills and cement factories and modernizing of the government owned textile factories, while during the Fourth and especially Fifth Plans period the state concentrated on investing in high capital-intensive heavy industries.[79] The government's own choice of technique influenced the selection of type of technology by private sector, and this was further accompanied by allowing the import of duty-free labor-saving machinery. The licencing procedure that was followed by the government for new establishments, was often made regardless of their implications for employment.[80] In addition, many entrepreneurs received large loans from government owned agencies to introduce the latest automatic machinery into their operations.[41]

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[78] ILO (1973), op. cit. p. 59.

[79] R. Looney, *The Economic Development of Iran*, (New York: Praeger, 1973), p. 123.

[80] The major aim of licensing system "... was to encourage the private sector to invest in manufacturing activities primarily for the production of durable and non-durable consumer goods and later for the production of intermediate and capital goods. It was designed to ensure that technical,

The problems of Iran's industry centered around the introduction of technology in a country with no tradition of modern techniques. Throughout the industrial sector, machinery and costly imported technology were employed inefficiently. One official Iranian report states that:

> During the years when labor was abundant, financial assistance by the government and the development banks had placed plentiful resources at the disposal of industrialists, and many of them were making high profits under the protection provided by the government. Some did not learn to economize in the use of labor, materials and equipment, and the need for careful management of these factors did not seem urgent. Therefore, many industrial units had become accustomed to waste of capital, new materials and surplus labor.[42]

But, these facts are not entirely surprising in that the industrial sector had to make impressive readjustment in a very short space of time and form a base of experience. In addition, entrepreneurs were faced with sudden increases in the cost of imported goods and raw materials, labor shortages, increasing wages, high land prices, and serious infrastructure shortcomings such as clogged ports and

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[40] (cont'd)licenses were granted would be able to provide reasonable assurance of their success ... . As a practical matter, the licenses would entitle the holder to receive all other permits connected with infrastructural facilities such as water, power, etc., at advantageous industrial rates, as well as financing from industrial development banks". J. W. Jacqz, ed., *Iran: Past, Present and Future*, (New York: Aspen Institute, 1976), p. 107.

[41] Looney (1973), op. cit., p. 123.

[42] Industrial and Mining Development Bank of Iran, *Annual Report*, (2535), p.13.

serious shortages in power supplies.

Whatever evidence there is suggests that there was a high degree of wastage in the industrial sector of the economy. A U.S. Government report suggested in 1977 that the waste factor in the Iranian economy as a whole was 40 percent.[83] Even the modern industrial sector suffered from serious drawbacks, for most of the plants producing finished goods were assembling rather than making the components of the goods they produced. Iran has no independent technology and relies on foreign firms for it. The exceptionally high cost character of the Iranian industry is revealed by an example that the General Motors Corporation of Iran calculated in late 1975 that it took 45 man hours to assemble their Chevrolet in Tehran, while the process was done in 25 hours in their plant in West Germany.[84] In addition, some factories suffered from the increasing costs of operation, heavy rises in transportation costs, and labor shortages after 1973.

A conventional justification for such inefficiencies is that wages in skilled jobs are low. But this argument does not hold due to the fact that wages in skilled jobs rose by up to 50 percent in 1974 and again by the same percentage in 1975, and these rates, plus the production weaknesses made Iranian industrial products highly priced compared with their international counterparts.[5]

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[83] U.S. Embassy, *Semi Annual Economic Trends Report*, Tehran, (May 1977). See also U.S. Area Handbook, *Iran:A Country Study*, (1978), p. 260 also pp. 315-17.
[84] Graham (1978), op. cit., p. 121.

What did protect the industrial sector were the extremely high tariff rates. The years of protection and subsidization by the government from the early 1960's created an inefficient industrial sector that could not compete internationally. As a direct effect of tariffs, domestic industries often charged much higher prices than the cost, insurance, and freight (c.i.f.) cost of imported products. The industries where domestic prices were equal to or lower than import prices were footwear, pharmaceuticals and some foodstuffs that were processed.

> By ranking industries according to the level of the excess of domestic prices over C.I.F import prices, a median value of 25-33 percent over world prices, with a range between 0 and 200 percent is found. This average is influenced by the fact that some of the old established industries, food canning and cotton textiles, are below the 33 percent rank. at the margin, that is, for the industries recently established or currently being considered, the excess domestic cost is unlikely to be below 33-40 percent.[6]

This report is from an estimate for 1972 and one can assume that the post 1973 high inflation has increased the gap.

To sum up, the upward pressures on prices could also be attributed to several interrelated factors in the industrial sector including: (a) the monopolistic power on the part of some large producers, (b) increases in the prices of the imported raw materials and intermediate products due to international price increases as a result of high dependence on imports, and (c) low productivity and high unit costs in the majority of industries. In addition, government protectionist policies contributed to these factors in several ways namely: (a) by limiting the extent of foreign competition by controlling the imports of consumer goods, (b) by imposing lower tariffs on capital and intermediate goods which are mostly available to large capital intensive producing units, and (c) by imposing higher tariffs on large number of consumer goods.

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[5] Central Bank of Iran, *Annual Reports and Balance Sheet*, (1975 and 1976).

[6] Looney (1973), op. cit., p. 88.

The services sector has grown very rapidly in recent years as a result of the combination of rapid industrialization and urbanization of the country. This sector includes traditional activities such as retail merchandising at the one end, and at the other end, relatively sophisticated and modern activities such as the provision of banking and insurance services.

This sector -- in terms of its share of GDP -- is the dominant sector of the Iranian economy (Table IV-3 above). On the whole this is not surprising, since the share of this sector is found to be large in many less developed economies. It has been argued that this phenomenon may be due to a number of factors such as the extent of the state bureaucracy, the relative buoyancy of purely commercial activities and the monopolistic position of many service workers with important qualifications.[47] In the case of Iran this general proposition gains particular significance when we consider that -- at the same time -- there is an external source of revenue and foreign exchange. It makes the participation of the state in the provision of services easier, payment of relatively large salaries possible, and the import trade more flourishing than it would have been otherwise. Table IV-6 shows the breakdown of the service sector into its component elements. Except for the 1959-1962 period, the public services have had the highest share in both GDP and total services at constant 1959 prices, with a high growth rate of more than 11 percent during the period covered by the study. It was said that an external source of revenue tends to expand the activities of the state and make high remunerations possible (It would have been interesting to compare the average earnings of all government employees in general and those of administrative members of the civil services in particular with earnings in the other groups of the services; but, unfortunately it was not possible to acquire the necessary data for such comparison). Of course this is not the only consideration, but where other conditions favorable to a large share of government are present, the relative absence of a financial constraint would tend to realize it more easily. This situation tend to deprive industry of an adequate supply of skill, and, in any

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[47] M. A. Katouzian, "The Development of the Service Sector: A

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⁸'(cont'd)New Approch," *Oxford Economic Papers*, (November 1970), pp.373-380.

Table IV-6

Average of Distribution and Growth Rates of Service by Main Groups (at constant 1959 Prices): 1959-77
(Percent)

	1959 - 1962		1963 - 1967		1968 - 1972		1973 - 1977		Average Growth Rate
	share in GDP	share in total services	share in GDP	share in total services	share in GDP	share in total services	share in GDP	share in total services	1959-77
Transportation & Communication	9.90	24.20	7.10	17.69	5.24	13.31	4.03	11.40	4.06
Domestic Trade	8.77	21.44	8.72	21.79	8.03	20.40	6.11	17.31	7.19
Banking, Insurance & Brokerage	2.44	5.97	2.85	7.13	4.25	10.78	5.91	16.69	17.07
Public Services	8.57	20.96	10.79	26.96	11.61	29.47	10.62	30.18	11.09
Other: Private Services & Ownership occupied dwelling	11.22	27.43	10.60	26.43	10.29	26.04	8.66	24.42	8.72

Source: Central Bank of Iran: *National Income of Iran: 1959-72*, p.21;

Central Bank of Iran: *Annual Reports and Balance Sheet*, 1356 (1977), p.92; and

IMF, *International Financial Statistics*, Yearbook 1980, pp.228-9 case makes it expensive to come by; in addition, it could affect incentives and divert unplanned man-power training towards service activities. In the case of Iran casual observation seems to support this, although it would be difficult to quantify with any degree of accuracy.

The share of domestic trade is the next highest item. But 'trade' is an all-inclusive term. It includes not only such traditional activities as shop-keeping and small crafts, but also the more modern type of activities like the 'production' of restaurant and cinema activities. The former expand and transform into a more efficient link between the producers and consumers as the country grows rapidly. The latter booms where incomes are rising fast as the income elasticity of demand for such 'new' services is bound to be high even in the conditions of underdevelopment.[11] In addition, there is a long tradition of merchant trade and predominance of commercial capital in the country, and a relative abundance of foreign exchange had made entry into foreign trade comparatively easy.

Commercial banking occupied a small share of GDP and total services. The rate of return was high but it was considered as a hazardous occupation. Nonetheless, the high growth rate of banking, insurance and brokerage (highest among all) is an encouraging sign. It shows that the money market clearly responded to the needs of the growing economic activities during the period of 1959-1977.

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[11] Ibid. section I.

The share and growth of the transportation and communication on the whole was disappointing, especially in view of the fact that the period of 1959-1977 has seen a great expansion in the television and aviation network of the country, constituting mainly passenger transport.

The wide disparity existing among sectoral growth rates has inevitably led to significant shifts in the relative shares of the main sector in total GDP. As Table IV-7 shows, the share of agriculture in GDP (at constant 1959 prices) declined from 28.6 percent in 1959 to under 9 percent in 1977; the share of industry (including manufacturing, mining, water and power) first increased from 10.70 percent in 1959 to 15.18 percent in 1971 and then dropped to 12.53 percent in 1977; and that of oil and gas rose from 15.75 percent in 1959 to 30.74 percent in 1977.

To examine the structure of Iran's economy in the light of the patterns of production in other less developed countries, the composition of its GDP will be compared with the expected patterns obtained from the intercountry study of Chenery and Syrquin (Ch. & S.).[11] For this comparison, Chenery and Syrquin patterns for every year of the period 1959-1977 will be calculated and the result, then, be compared with the actual composition of production in Iran during this period.

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[11] H. Chenery and M. Syrquin, *Patterns of Development: 1950-1970*, (London: Oxford university Press, 1975).

Table IV-7

Sectoral Shares of GDP at constant 1959 Prices
(percent)

	Agri-culture	Oil & Gas	Industry	Cons-truction	Services	Total
1959	28.55	15.75	10.70	4.45	40.55	100.00
1960	27.68	15.68	11.05	4.51	41.08	100.00
1961	26.79	16.04	11.16	4.25	41.76	100.00
1962	26.40	17.55	12.07	3.76	40.22	100.00
1963	24.96	17.94	12.61	3.96	40.53	100.00
1964	25.36	16.69	12.66	4.04	41.25	100.00
1965	25.09	17.29	13.09	4.92	39.61	100.00
1966	23.29	18.39	13.87	4.40	40.05	100.00
1967	22.25	19.53	14.45	4.92	38.85	100.00
1968	21.19	19.75	14.75	5.03	39.28	100.00
1969	19.92	20.45	15.06	5.20	39.37	100.00
1970	19.09	21.78	15.10	4.87	39.16	100.00
1971	16.99	27.30	15.18	5.03	35.50	100.00
1972	15.91	20.81	14.88	4.61	43.79	100.00
1973	12.54	31.44	13.57	4.22	38.23	100.00
1974	9.67	45.96	10.79	3.13	30.45	100.00
1975	9.38	38.63	11.50	5.85	34.64	100.00
1976	9.26	36.62	11.51	7.75	34.86	100.00
1977	8.99	30.74	12.53	9.18	38.56	100.00

Source: Table IV-3 above.

Tables IV-8 to IV-12 provide all the relevant information required for the above comparison. Tables IV-8, IV-9 and IV-10 supply the details for calculation of the Ch. & S. patterns. Tables IV-11 and IV-12 give the Ch. & S. patterns and the actual distribution of production among various sectors.

As shown in Table IV-12, the actual share of primary production (which includes oil to make it consistent with Ch.& S. classification) has declined at a compound rate of only 0.11 percent compared to a rate of 1.61 for the Chenery and Syrquin norm. Similarly, the average annual growth rate of 0.65 percent for industrial sector share falls far short of 2.09 percent expected according to the Ch.& S. pattern. Table (IV-12) also indicates that actual GDP share of primary production has been considerably higher, and that of industry substantially lower than the expected norms of Chenery and Syrquin. These departures from the norm are symptomatic of Iran's oil rich base, which tends to increase the share of primary production. They also point to the relative backwardness of the services sector, a fact that in recent years has caused serious problems for the economy in the face of rising oil revenues, revealing bottlenecks and generating strong inflationary pressures.

The extent of sectoral contributions to the growth of total output is better appreciated if a sectoral breakdown of GDP growth rates is obtained. According to Tables IV-13 and IV-14, oil production played a dominent role in the

Table IV-8

Structure of Production for less Developed Countries

Shares of Production	Constant	lnY	(lnY^2)	lnN	(lnN)^2	F	R^2	SEE	No. of Observations
Primary*	2.144 (7.384)	−0.474 (4.792)	0.029 (3.420)	−0.061 (2.526)	0.008 (1.855)	−0.662 (6.079)	0.790	0.082	85
Industry**	−0.457 (2.340)	0.122 (1.840)	−0.003 (0.574)	0.066 (4.067)	−0.008 (2.865)	0.261 (3.563)	0.763	0.055	85
Services***	−0.593 (2.322)	0.312 (3.594)	−0.023 (3.195)	−0.014 (0.661)	0.002 (0.466)	0.389 (4.066)	0.379	0.072	85

GNP = Gross National Product in constant factor Prices (in millions of 1964 US dollars).
N = Population
Y = GNP/N
F = capital inflow (net imports of goods and services) as percent of GDP (at current prices)
GDP = Gross Domestic Produce at current market Prices.
* = agriculture (including forestry, hunting & fishing) and Mining (including quarrying)
** = includes manufacturing, construction, utilities and transportation and communication
*** = includes domestic trade; banking, insurance and brokerage; ownership of dwelling; public services; private services; others

Source: Chenery H. and Syrquin M., Patterns of Development: 1950 - 1970, pp. 180, 182, 184 and 214.

Table IV-9

The Independent Variables for Estimation of Chenery and Syrquin Patterns for Iran

	Net Imports of Goods & Services (Billions of Rials)	GDP at current market prices (Billions of Rials)	F* (Percent)	at constant 1964 prices		N million persons	Y*** at constant 1964 Prices dollars
				Billions of Rials	Billions of Dollars**		
1959	-9.4	299.1	-3.14	316.60	4.18	20.93	199.69
1960	-9.4	328.4	-2.86	332.34	4.39	21.52	203.87
1961	-15.2	346.0	-4.39	342.13	4.52	22.13	204.09
1962	-22.9	367.0	-6.24	359.51	4.75	22.77	208.43
1963	-40.3	394.2	-10.22	381.01	5.03	23.43	214.68
1964	-41.5	436.1	-9.52	405.20	5.35	24.08	222.14
1965	-6.4	478.2	-1.34	465.85	6.15	24.81	247.88
1966	-2.5	522.6	-0.48	520.35	6.87	25.54	268.96
1967	2.0	577.1	0.35	578.12	7.64	26.30	290.19
1968	6.1	658.8	0.93	644.63	8.51	27.08	314.25
1969	6.4	741.9	0.86	721.33	9.52	27.89	341.43
1970	4.7	841.5	0.56	812.12	10.72	28.66	374.08
1971	-41.3	1,014.3	-4.07	915.88	12.09	29.78	406.01
1972	-41.8	1,268.4	-3.30	1,089.00	14.38	30.55	470.58
1973	-300.2	1,868.6	-16.07	1,229.08	16.23	31.30	518.39
1974	-818.9	3,137.0	-26.10	1,345.26	17.76	32.14	552.56
1975	-372.1	3,561.1	-10.45	1,373.42	18.14	33.02	549.09
1976	-592.6	4,606.6	-12.86	1,526.38	20.15	33.90	594.40
1977	-326.8	5,393.3	-6.06	1,493.55	19.72	34.27	575.34

* F = ((Net imports of goods and services)/GDP) X 100

** A constant Exchange Rate of 75.75 RlS/$ has been used

*** Y = GNP/N, where N is population.

Source: Calculated by the author from information supplied in IMF, International Financial Statistics, yearbook 1980, pp. 226-9.

Table IV-10

Estimated Share of Major Sectors in GDP
Chenery and Syrquin Pattern (percent)

	Primary	Industry	Services
1959	35.62	22.36	37.80
1960	35.06	22.66	38.05
1961	36.02	22.32	37.45
1962	36.87	22.07	36.87
1963	38.99	21.35	35.51
1964	37.94	21.88	36.00
1965	30.77	25.04	39.85
1966	28.96	26.03	40.64
1967	27.24	26.95	41.36
1968	25.70	27.84	41.98
1969	24.57	28.59	42.33
1970	23.54	29.33	42.59
1971	25.53	28.88	41.09
1972	23.21	30.37	41.87
1973	30.54	27.89	37.16
1974	36.47	25.83	33.40
1975	26.16	29.89	39.48
1976	26.91	29.95	38.70
1977	22.74	31.47	41.28

Source: Calculated by the author on the basis of information supplied in Tables IV-8 and IV-9 above.

Table IV-11

Actual Share of Major Sectors in GDP at constant 1964 prices (percent)

	Primary*	Industry**	Services***
1959	44.30	24.34	31.36
1960	43.36	24.60	32.03
1961	42.83	23.58	33.58
1962	43.95	23.98	32.07
1963	42.90	23.64	33.46
1964	42.06	23.16	34.79
1965	42.39	24.53	33.08
1966	41.68	24.53	33.79
1967	41.78	25.14	33.08
1968	40.94	25.27	33.79
1969	40.37	25.48	34.16
1970	40.87	25.10	34.04
1971	44.29	24.74	30.98
1972	36.72	23.83	39.44
1973	43.98	21.96	34.06
1974	55.62	17.09	27.29
1975	48.01	21.22	30.77
1976	45.88	22.71	31.41
1977	39.73	25.50	34.77

* Includes: agriculture, forestry, fishery, hunting and *oil*.

** Includes: manufacturing, construction, utilities and transportation and communication.

*** Includes: domestic trade, banking, insurance and brokerage, ownership and dwelling, public services, private services and other.

These classifications are designed to make consistent comparison with Ch. & S. patterns.

Source: Calculated by the author from information supplied in:
1) I.M.F., *International Financial Statistics*, Yearbook 1980,
2) Central Bank of Iran, *National Income of Iran: 1959-1972*, and
3) Central Bank of Iran, *Annual Reports and Balance Sheet*, (1977).

Table IV-12

Comparison of Iranian and Normal
(Ch. & S. Pattern) Shares of GDP
(percent)

	1959-62	1963-67	1968-72	1973-77	Average Growth Rates: 1959-77
Actual Shares of GDP in Iran:					
Primary	43.61	42.16	40.64	46.64	-0.11
Industry	24.13	24.20	24.88	21.70	0.65
Services	32.26	33.64	34.48	31.66	1.06
Normal Shares of GDP (Ch. & S.) Pattern:					
Primary	35.89	32.78	24.51	28.56	-1.61
Industry	22.35	24.25	29.00	29.01	2.09
Services	37.54	38.67	41.97	38.01	0.70

Source: Tables IV-10 and IV-11.

growth of output, accounting for 43.55 percent of growth in GDP (at constant 1959 prices) over the entire period 1959-1975. In contrast, agricultural sector contributed a mere 8 percent, industry 12 percent, construction 6.17 percent, and services added the remaining 30.27 percent.

Having described the general characteristics of growth and structural change in Iran, we now turn to their causes.

C. Factor Inputs, Factor Productivity and Growth

The rapid growth experienced by the Iranian economy since the early 1960's was made possible by the substantial increase in the volume of the primary inputs, especially labor and capital. This section is devoted to an examination of the major trends in factor uses and factor productivities in Iran over the 1959-1977 period.

1. Growth of Labor Supply

Between 1962 and 1975 (availability of data dictates the choice of this period) the labor force grew from about 7 million to over 10 million, this growth being the product of a large increase in population and an almost constant labor force participation rate, Table IV-15. This Table also shows that during the same period the labor force increased by 43.6 percent, while the number of fully or partially employed rose by 48.5 percent; the employment went up from 95.7 percent to 99 percent of the labor force between 1962 and 1975.

Table IV-13

Sectoral Contribution to the GDP Growth Rates at Constant 1959 prices (percent)

	Agri-culture	Oil & Gas	Industry	Cons-truction	Services	GDP
1960	14.01	14.64	16.63	5.46	49.2	100.00
1961	-0.68	27.19	14.27	-3.69	62.91	100.00
1962	20.24	41.45	26.62	-4.01	15.70	100.00
1963	3.01	23.84	20.75	6.98	45.42	100.00
1964	34.07	-10.25	13.74	5.71	56.73	100.00
1965	22.75	22.52	16.86	12.57	25.30	100.00
1966	6.63	28.49	21.08	-0.34	44.14	100.00
1967	13.01	29.66	19.61	9.55	28.17	100.00
1968	12.69	21.51	17.18	5.85	42.77	100.00
1969	9.45	26.23	17.55	6.67	40.10	100.00
1970	12.52	32.24	15.49	2.28	37.47	100.00
1971	0.32	71.13	15.81	6.27	6.47	100.00
1972	9.54	-17.57	13.11	2.10	92.82	100.00
1973	-16.16	122.06	2.33	0.96	-9.19	100.00
1974	-27.22	232.12	-24.77	-10.87	-69.26	100.00
1975	-0.72	-214.51	35.90	99.86	179.47	100.00
1976	8.11	17.77	11.63	25.55	36.94	100.00
1977*	21.64	315.40	-36.83	-59.89	-140.32	100.00

* Note that in 1976-77, GDP declined at a rate equal to -2.07 percent. Therefore agricultural and oil sector both contributed to the decline (shown with positive contributions) while the other sectores contributed to the growth of GDP (shown with negative contributions).

Source: Table IV-3 above.

Table IV-14

Average Annual Sectoral Contribution to GDP Growth Rates at Constant 1959 Prices (percent)

	1959-62	1963-67	1968-72	1973-77	1959-77
Agriculture	11.19	15.89	8.90	-2.87	7.96
Oil and Gas	27.76	18.85	26.71	94.57	43.55
Industry	19.18	18.41	15.83	-2.35	12.05
Construction	-0.75	6.90	4.63	11.12	6.17
Services	42.62	39.95	43.93	-0.47	30.27
Total	100.00	100.00	100.00	100.00	100.00

Source: Table IV-13.

Economic development has also been characterized by significant shifts in the distribution of the labor force among major economic sectors. As shown in Table IV-16, employment in agricultural sector (including forestry and fisheries) increased moderately over the 1960's and then declined towards 1975. In 1975, the agricultural employment stood 2.2 percent below its 1962 level. At the same time, employment in manufacturing and mining went up by 122 percent, in construction by 115 percent, and in services by 92 percent. If these employment changes are related to changes in value-added for these same broad sectors between 1962 and 1975, it can be seen from Table IV-17 that the value-added per worker, measured in constant 1959 prices, rose by 29 percent in agriculture; by 52.3 percent in manufacturing; more than tripled in oil and gas; by 157 percent in construction; and rose by almost 60 percent in

Table IV-15

Labor Force and Employment
(millions of Persons)

	Population (1)	Labor Force (2)	Employed (3)	Labor Participation Rate (percent)(4)	Employment Rate percent(5)
1962	22.27	7.1	6.8	31.2	95.7
1964	24.08	7.4	7.2	30.7	97.3
1966	25.54	7.8	7.6	30.5	97.4
1968	27.08	8.3	8.1	30.6	97.7
1970	28.66	8.7	8.5	30.4	97.7
1972	30.55	9.2	9.0	30.1	97.8
1974	32.14	9.9	9.8	30.8	98.9
1975	33.02	10.2	10.1	30.9	99.0

Source: Column (1): I.M.F., *International Finnancial Statistics*, Yearbook 1980.
Columns (2) and (3): Echo of Iran, *Iran Almanac and Book of Facts*, issues 1969-1978.

Table IV-16

Sectoral Distribution of Employment (thousands of Persons)

	1962	1964	1966	1968	1970	1972	1974	1975
Agriculture	3672	3836	3774	3808	3718	3659	3612	3592
Oil & Gas	36	40	44	47	50	50	90	90
Manufacturing and Mining	1028	1086	1274	1454	1701	1820	2125	2285
Construction	407	440	517	554	600	710	812	875
Services	1701	1782	1945	2187	2461	2886	3032	3258

Source: Echo of Iran, *Iran Almanac and Book of Facts*, issues 1969-1978.

Table IV-17

Change in Worker's Productivity between 1962 and 1975.

	Number of Workers (Thousands of Persons)			Value Added (billions of 1959 rials)			Value Added Per Workers (Thousands of 1959 rials)		
	1962	1975	% change	1962	1975	% change	1962	1975	% change
Agriculture	3,672	3,592	-2.2	92.19	116.33	26.2	25.11	32.39	29.0
Manufacturing & Mining	1.028	2,285	122.3	42.15	142.67	238.5	41.00	62.44	52.3
Oil & Gas	36	90	150.0	61.27	479.32	682.3	1,701.94	5,325.78	212.9
Construction	407	875	115.0	13.13	72.57	452.7	32.26	82.94	157.1
Services	1,701	3,258	91.5	140.42	429.78	206.1	82.55	131.92	59.8
GDP	6,844	10,100	47.6	349.16	1,240.67	255.3	51,02	122.84	140.8

Source: Tables IV-3, and IV-16 above.

services.

Looking at Table IV-17 somewhat differently, of the 255 percent increase in total value added, roughly one-third can be attributed to the increased employment and two-thirds to rising production per worker. It could also mean that this is not simply the result of an improved labor force but reflects the expansion of capital facilities and generally improved efficiency of economic organization.

2. Capital Formation

Investment has played a basic role in achieving the high rates of overall growth registered during the 19 years course of this study. Real gross fixed capital formation (at 1959 prices) rose from 49.8 billion rials in 1959 to 456.7 billions in 1977, an increase of more than 9 times, Table IV-18. Real investment declined at an average rate equal to 0.44 percent during 1959-1962; increased during 1963-1967 at 18.8 percent, then its growth slowed down during 1968-1972 growing at an average annual rate of 15.6 percent and finally increased at a high rate of almost 18.0 percent during the Fifth Plan period (1973-1977). This growth caused the investment-GDP ratio to increase from 16.65 percent in 1959 to almost 34 percent in 1977 (Table IV-18). The Table shows that the investment-GDP ratio rose from a low 14 percent during the recessionary condition of the early 1960's to a high level of almost 27 percent for the 1973-1977 period, the period that witnessed rapid increases

Table IV-18

Capital Formation In Iran: 1959-77
(Billions of 1959 Rials)

	Gross Capital Formation (Investment)	Rate of Growth of Investment (percent)	GDP	Investment/ GDP Ratio
1959	49.80		299.10	16.65
1960	53.67	7.77	318.16	16.87
1961	51.17	-4.67	328.46	15.59
1962	48.90	-4.43	349.16	14.01
1963	48.61	-0.59	372.10	13.06
1964	54.78	12.68	389.27	14.07
1965	77.59	41.66	433.98	17.88
1966	82.84	6.77	481.04	17.22
1967	110.63	33.54	535.15	20.67
1968	124.69	12.71	601.81	21.72
1969	142.23	14.07	674.70	21.08
1970	151.24	6.33	760.71	19.88
1971	182.98	20.99	856.46	21.36
1972	226.85	23.98	1,001.18	22.66
1973	217.48	-4.13	1,118.59	19.44
1974	216.02	-0.67	1,205.80	17.92
1975	371.25	71.86	1,240.67	29.92
1976	440.47	18.64	1,372.93	32.08
1977	456.70	3.68	1,344.56	33.97

Source: Calculated by the author from information supplied in: I.M.F., *International Financial Statistics*, Yearbook 1980.

in oil revenues and the huge expenditures of the Fifth Development Plan.

D. Growth and Structure of Demand

Concomitant with the rapid growth of output, the period 1959-1977 witnessed a substantial increase in the level of aggregate demand. During this period, total domestic demand, measured in constant 1959 prices, rose from 289.7 billion rials to 1263.09 billions, an increase of more than 400 percent (Table IV-19). Much of the increase in demand occured as a result of the surge in oil revenues. Between 1973 and 1977 domestic demand for goods and services rose from 939 to 1263 billions at 1959 prices.

Between 1959 and 1977 the economy also experienced significant shifts in the structure of aggregate demand. Indeed, the rapid economic growth can in part be explained by the shift of expenditure from consumption to investment and the shift of purchasing power from the private to the public sector. According to Table IV-20, the share of investment in total available resources (GDP + import surplus) increased from 17 percent in 1959 to 20 percent in 1970 and further to 36 percent in 1977. During this same period, the share of public investment which accounted for 39.5 percent of total investment in 1959, increased to 56 percent in 1977. As a result, the share of public investment in total available resources increased from 6 percent during 1959-1962 to almost 17 percent in 1973-1977 period (Table

Table IV-19

Uses of Gross National Product, 1959-77
(Billions of 1959 Rials)*

	Private consumption	Public consumption	Gross fixed capital formation	Exports	Imports	GDP
1959	209.40	30.50	49.80	60.20	50.80	299.10
1960	223.99	31.39	53.67	58.32	49.22	318.16
1961	230.49	32.37	51.17	64.27	49.84	328.46
1962	244.89	33.58	48.90	69.07	47.28	349.16
1963	247.40	38.04	48.61	75.51	37.47	372.10
1964	255.42	43.25	54.78	72.63	36.66	389.42
1965	290.77	59.81	77.59	68.88	63.07	433.98
1966	327.04	68.85	82.84	77.23	74.93	481.04
1967	346.72	79.66	110.63	91.90	93.75	535.15
1968	390.24	92.45	124.69	104.41	109.98	601.81
1969	428.06	110.22	142.23	121.14	126.96	674.70
1970	485.72	128.01	151.24	138.94	143.19	760.71
1971	478.68	159.93	182.98	203.16	168.29	856.46
1972	541.95	199.38	226.85	243.51	210.51	1001.18
1973	526.61	194.79	217.48	392.04	212.33	1118.59
1974	433.50	241.51	216.02	571.46	256.69	1205.80
1975	458.49	281.30	371.25	514.44	384.80	1240.67
1976	456.74	299.11	440.47	457.85	371.23	1372.93
1977	538.69	267.70	456.70	452.53	371.06	1344.56

* Calculated by author from information supplied in the source (see Appendix I).

Source: I.M.F., *International Financial Statistics*, Yearbook 1980.

IV-20).

It can be seen from Table IV-20 that the changing patterns of consumption have also been very significant. The share of total consumption declined from almost 84 percent of total demand during 1959-1962 to just over 69 percent during 1973-1977 period. During this same period, there was a major shift from private to public consumption. Public consumption, that accounted for only 10 percent of total demand in 1959-1962, increased its share to almost 24 percent during 1973-1977 period. This substantial gain for the public sector expenditure was made possible by the rapid growth of the petroleum exports and the fact that the government has been the main recipient of income from the oil sector.

E. The Pattern of Foreign Trade

As Iran's economy has developed, its orientation toward foreign trade and its interdependence with the rest of the world has been enhanced. As shown in Table IV-21, the share of exports in Iran's GDP increased from about 20 percent in 1959 to almost 32 percent in 1977. Since the rise in non-oil exports of goods and services was almost equal to the growth in GDP, almost all of the change in the rising share of exports in the GDP has been due to the rising volume and value of oil exports. According to Table IV-22, Iran's total foreign exchange receipts from exports including oil, traditional goods, industrial goods and services increased

Table IV-20

Consumption and Investment Shares of Total Available Resources* (percent)

	Consumption			Investment			Total
	Private	Public	Total	Private	Public	Total	
1959	72.28	10.53	82.81	10.41	6.78	17.19	100
1960	72.47	10.16	82.63	11.61	5.76	17.37	100
1961	73.40	10.31	83.71	10.13	6.16	16.29	100
1962	74.81	10.26	85.07	9.37	5.56	14.93	100
1963	74.06	11.39	85.45	8.60	5.96	14.55	100
1964	72.26	12.24	84.50	9.83	5.67	15.50	100
1965	67.91	13.97	81.88	9.44	8.68	18.12	100
1966	68.31	14.38	82.69	9.68	7.63	17.31	100
1967	64.57	14.83	79.40	10.56	10.04	20.60	100
1968	64.25	15.22	79.47	9.09	11.44	20.53	100
1969	62.90	16.20	79.10	8.32	12.58	20.90	100
1970	63.50	16.73	80.23	7.97	11.80	19.77	100
1971	58.26	19.47	77.73	9.65	12.62	22.27	100
1972	55.98	20.59	76.57	11.35	12.08	23.43	100
1973	56.09	20.75	76.84	10.16	13.00	23.16	100
1974	48.65	27.11	75.76	9.71	14.53	24.24	100
1975	41.27	25.32	66.59	16.33	17.08	33.41	100
1976	38.18	25.00	63.18	16.84	19.98	36.82	100
1977	42.65	21.19	63.84	15.86	20.30	36.16	100

*Based on GDP series at constant 1959 prices.

Source: Calculated on the basis of Table IV-19 and:
Central Bank of Iran, *National Income of Iran: 1959-72,*, pp. 64-65; and
Central Bank of Iran, *Annual Reports and Balance Sheet*, 2536, (1977).

Table IV-21

Shares of Exports and Imports in GDP* (percent)

	Exports**			Imports**
	Oil	Non-oil	Total	
1959	17.49	2.39	19.88	13.55
1960	16.48	2.73	19.21	12.87
1961	16.41	2.94	19.35	11.80
1962	17.53	2.88	20.41	10.30
1963	17.74	2.67	20.41	8.80
1964	16.97	2.20	19.17	9.95
1965	17.32	2.53	19.85	12.36
1966	17.70	2.48	20.18	12.48
1967	19.77	2.05	21.82	14.10
1968	18.86	2.15	21.01	15.18
1969	19.36	2.53	21.89	15.88
1970	19.56	2.20	21.76	14.93
1971	25.40	2.41	27.81	15.45
1972	21.33	2.36	23.69	15.47
1973	20.50	2.07	22.57	14.69
1974	44.61	1.43	46.04	15.64
1975	37.70	1.11	38.81	24.50
1976	35.60	0.93	36.53	24.35
1977	31.02	0.87	31.89	20.72

* Based on GDP series at current market prices.

** All figures are converted from U. S. dollars into Iranian rials using the exchange rate series 'rf' (Par Rate/Market Rate) provided in the source.

Source: I.M.F., *International Financial Statistics,* Yearbook 1980, pp. 226-29.

Table IV-22

Balance of Payments of Iran, 1959 - 1977
(Billions of Current Rials)*

	Exports (fob)			Imports (fob)	Net of other goods, services & Income	Unre-quited Transfers	Net Current Account (fob)	Net Capital Account	Balance of Payments
	OIL	Non-Oil	Total						
1959	52.312	7.152	59.464	40.526	-27.346	3.409	-4.999	2.576	-2.423
1960	54.114	8.986	63.100	42.269	-31.133	3.333	-6.969	2.575	-4.394
1961	56.789	10.174	66.963	40.829	-30.452	3.863	-0.455	4.015	3.560
1962	64.335	10.582	74.917	37.799	-34.315	1.288	4.091	0.606	4.697
1963	69.929	10.518	80.447	34.694	-40.678	2.045	7.120	-4.923	2.197
1964	76.236	9.892	86.128	44.693	-38.936	0.833	3.332	-7.195	-3.863
1965	82.810	12.105	94.915	59.085	-43.935	0.833	-7.272	11.590	4.318
1966	92.476	12.968	105.444	65.221	-50.147	0.833	-9.091	10.000	0.909
1967	114.092	11.805	125.897	81.355	-54.843	0.682	-9.619	12.801	3.182
1968	124.216	14.179	138.395	99.990	-70.144	0.379	-31.360	29.315	-2.045
1969	143.625	18.783	162.408	117.791	-85.749	0.303	-40.829	42.117	1.288
1970	164.567	18.521	183.088	125.593	-96.203	0.303	-38.405	31.057	-7.348
1971	257.661	24.432	282.093	156.727	-134.608	0.303	-8.939	38.406	29.467
1972	270.481	29.944	300.425	196.268	-133.926	0.303	-29.466	51.585	22.119
1973	382.973	38.723	421.696	274.495	-136.386	-0.138	10.677	-6.061	4.615
1974	1,399.459	44.741	1,444.200	490.755	-121.657	-2.232	829.556	-354.423	475.133
1975	1,342.474	39.526	1,382.000	872.408	-189.930	-1.218	318.444	-311.004	7.440
1976	1,639.725	42.794	1,682.519	1,121.656	-228.362	-1.404	331.097	-335.381	-4.284
1977	1,673.134	46.814	1,719.948	1,117.373	-243,964	-0.636	358.875	-117.082	241.793

* All figures are converted from US dollars to Iran's rials using the exchange rate series "rf" in IMF, International Financial Statistics, 1980 Yearbook, pp.226-7.

Source: IMF, Balance of Payments Yearbook, various issues and
IMF, International Financial Statistics, 1980 yearbook.

from 59.5 billion rials in 1959 to 300.5 billions at the end of the Fourth Plan (1972) and further to almost 1,720 billions in 1977. Although exports of goods and services increased in 1959-1977 by more than 6-fold, as is shown in Table IV-22, yet due to a very rapid increase in the exchange receipts from the oil sector, the share of non-oil exports in total exchange revenues decreased from 12.0 percent in 1959 to 2.7 percent in 1977.

Aside from exports of oil, which contributed increasingly to Iran's foreign trade -- between 85 percent and 97 percent of total exchange receipts during 1959-1977 period -- the country's major exports consists of traditional goods such as carpets, cotton, animal skins and industrial goods such as clothing, shoes, electrical and transportation equipments.

Iran's payments for imports of goods and services increased from 40.5 billion rials in 1959 to over 1,117 billions in 1977, Table IV-22; an increase of more than 27 times. Though in the 1960's and early 1970's Iran experienced a consistent deficit in her current accounts which was financed by borrowing from abroad, the rise in oil prices in 1973 improved the current account position to the tune of almost 830 billion rials in 1974. The rapid development of the economy triggered by the enhanced foreign exchange position of the country did, however, lead to a quick erosion of the trade surplus. In 1975, the export surplus was already down to 318 billion rials but then rose slightly to 359 billions by 1977.

For sustaining the pace of her economic growth, Iran relied on the international markets to provide her with raw and intermediate materials, machinery and equipment and food. Imports were used effectively for meeting domestic shortages and thus controlling the rate of inflation, unavoidable in the face of rapid growth and structural change. Apparently, the main concern was to regulate imports in such a manner as to provide enough incentives and protection for the domestic industries. Yet, whenever domestic supply fell short of the domestic demand, imports were encouraged by lowering tariffs and by providing government subsidies.

Iran's major import categories are: machinery and equipment; food; and industrial raw and intermediate products. Imports of machinery including transport equipment have increased steadily from 36.3 percent of total in 1960 to 42.9 percent in 1977, Table IV-23. Meanwhile, the share of food in total imports has increased from 7 percent in 1970 to more than 17 percent in 1977, in spite of the emphasis placed on the growth of the agricultural sector during the Fifth Plan. The rise in food imports has been unavoidable in the face of high income elasticity of demand for food, rising income and population, and unprecedented rise in domestic food prices. Yet in the long run, Iran must rely on her domestic resources if the economy and its balance of payments are not to be over-burdened by rising

Table IV-23

Composition of Iran's Imports of Goods* (percent)

	1960	1965	1970	1973	1975	1977
Food & live animals	14.1	12.5	6.6	10.5	16.0	17.2
Non-Edible raw-materials	3.9	6.5	5.3	5.4	3.3	3.1
Chemical products	8.1	8.5	9.2	9.5	7.1	7.1
Iron & steel	14.1	14.6	15.1	15.6	15.8	16.1
Machinary, including transport.	36.3	31.3	40.5	37.5	42.5	42.9
All other goods	23.6	26.6	23.3	21.5	15.3	13.6

* In current prices.
Source: Central Bank of Iran, *Annual Reports and Balance Sheet*, (1970), pp. 138-39; and
——————, (1975), pp. 160-61; and
——————, (1977), pp. 154-55.

food imports.

Among other major imports are iron and steel and petrochemicals, taking up 23 percent of total imports in 1975. Given Iran's potential comparative advantage in raw material and energy intensive industries, it could be expected that Iran has the capability to provide for her domestic iron and steel and chemical requirements in addition to exporting significant amounts.

F. Foreign Aid and Capital Movement

Through most of the Third and Fourth Plans -- 1963 to 1972 -- Iran experienced a consistent deficit in her current account which was largely financed by borrowing from abroad. By 1973, the total outstanding government debt had reached the staggering sum of $3.5 billion, with the annual debt service approching $620 million.[10] By far the most important source of borrowing was the United States which accounted for almost 43 percent of the total debt in 1973; Western Europe and Japan contributed 34 percent, and the remaining 23 percent was claimed by the Soviet block nations.[11] After 1973, however, the rise in oil prices substantially improved Iran's current balance position to the tune of 359 billion rials (Table IV-22 above). This development enabled Iran to reduce her foreign debt, from $3.5 billion in 1973 to $2.2

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[10] Echo of Iran, *Iran Almanac and Book of Facts*, (Tehran: 1975), p. 199.
[11] Ibid., pp. 200-202.

billion in 1975,[12] and to use the surplus for assisting countries faced with a deficit in their balance of payments, through international financial institutions and bilateral agreements. The total outflow of such loans and investments amounted to $2.8 billion in 1974 and another $4.0 billion in 1975.[13] Iran extended loans for a number of reasons:

1. Offsetting the inflationary effect of massive reserves within the country;
2. Securing a mutual deal for raw materials or commodities with other countries;
3. Creating strong links between the economies of Iran and neighbouring countries.

Loans primarily tied to industrial and agricultural projects comprised the bulk of Iran's loans. Such loans were extended to India, Egypt and Pakistan (90 percent of total aid in 1974) among others.[14] They are soft loans with less than commercial rates. Such terms were designed to ease the financial problems of the recipient country as well as secure raw materials and other commodities needed by the Iranian economy. Thus, iron ore and aluminum from India feed Iran's steel and aluminum industries, while cement from Pakistan aid Iran's burgeoning cement industry. A large portion of the Egyption loan, on the other hand, funded the widening of Suez Canal. If the widening of the Suez Canal can successfully accomodate super-tankers and divert them from the alternative route around the continent of Africa, refined and crude oil transportation costs for Iran could be lowered substantially. Hence in the long run Iran benefits.

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[12] Echo of Iran, *Iran Alamac and Book of Facts*, (Tehran: 1977), pp. 187-191.

[13] Central Bank of Iran, *Annual Reports and Balace Sheet*, (1975), pp. 54-55.

[14] Ibid.

Iran also extended large loans to the industrialized nations ($2.2 billion to UK and France in 1975) and international financial institutions ($645 milion to IMF and World Bank) in addition to other foreign investments.[35]

G. Financial and Price Development

1. *Liquid Assets*

An important feature of the Iranian economy is that the total stock of liquid assets, defined as the money supply and liquid savings, generally increased faster than the gross domestic product at current prices in the 1959-1977 period. As shown in Table IV-24, the share of total liquid assets (M1 + Quasi money) to GDP increased from 16.64 percent in 1959 to 19.57 percent in 1962, to almost 27 percent by 1967, and further to 35.32 percent in 1977. The Table also shows that the share of money (narrowly defined to include currency and demand deposits) as a percentage of GDP has remained fairly stable during 1959-1977, implying a constant velocity of circulation of about 7 over the 19 years covered by this study. During this same period, however, the share of quasi-money in GDP increased substantially, from 3.28 percent in 1959 to 20 percent in

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[35] Ibid., p. 56.

Table IV-24

Liquid Assets & Reserve Money in Iran, 1959-77
(Billions of Current Rials)

	Money (M1) *	Quasi Money **	Total (M2) ***	Reserve Money	GDP	% Share of GDP		
						Money	Quasi Money	Total
1959	39.96	9.80	49.76	35.32	299.1	13.36	3.28	16.64
1960	45.15	27.13	72.28	45.69	328.4	13.75	8.26	22.01
1961	38.68	15.22	53.90	26.22	346.0	11.18	4.40	15.58
1962	50.05	21.76	71.81	36.21	367.0	13.64	5.93	19.57
1963	57.49	28.21	85.70	43.80	394.2	14.58	7.16	21.74
1964	64.59	34.85	99.44	47.67	449.3	14.38	7.76	22.14
1965	74.13	40.18	114.31	55.89	478.2	15.50	8.40	23.90
1966	82.43	48.18	130.61	58.95	522.6	15.77	9.22	24.99
1967	96.87	58.74	155.61	68.20	577.1	16.79	10.18	26.97
1968	105.14	74.63	179.77	76.35	658.8	15.96	11.33	27.29
1969	111.93	99.73	211.66	86.84	741.9	15.09	13.44	28.53
1970	128.34	121.25	249.69	105.87	841.5	15.25	14.42	29.67
1971	154.93	154.68	309.61	131.26	1014.3	15.27	15.25	30.52
1972	214.33	204.44	418.77	179.48	1268.4	16.90	16.12	33.02
1973	278.09	267.53	545.62	246.27	1868.6	14.88	14.32	29.20
1974	381.45	397.69	779.14	330.06	3137.0	12.16	12.68	24.84
1975	458.24	591.64	1049.88	411.90	3561.1	12.87	16.61	29.48
1976	668.04	842.71	1510.75	573.44	4606.6	14.50	18.29	32.79
1977	822.02	1082.85	1904.87	732.99	5393.3	15.24	20.08	35.32

* M1=currency outside banks + Demand deposits + Official entities deposits.
** Quasi Money=Saving deposits + Time deposits
*** M2=M1 + Quasi Money
Source:IMF, *International Financial Statistics*, Yearbook 1980.

1977.

Table IV-25 throws some light on the changing structure of the total liquid assets. Between 1959 and 1977, the share of currency outside Banks in money supply (M1) remained fairly constant at about 30 percent. However, due to a very rapid growth of saving and time deposits -- which increased at an annual average rate of almost 35 percent during 1959-1977 period (Table IV-26) -- the share of money in total liquidity (M2) declined sharply from 80.3 percent in 1959 to 58.5 in 1968 and further to 43 percent in 1977.

The main factor contributing to the rapid growth of liquidity in the economy has been the large inflows of petro-dollars, a process that has been particularly pronounced after 1973. To this should be added the sizable deficits incurred by the public sector over most of the period under study. Inflows of foreign exchange and public sector deficits bolstered the monetary base and were therefore instrumental in expanding the supply of liquidity (Table IV-26).

There has been little development of financial assets outside the banking system. Insurance Companies have remained very small, and the limited number of savings and loans associations in existence are still in their infancy.[4]

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[4] For more detail about the structure of the financial sector in Iran refer to: Chase Manhattan Bank, *A Capital Markets Study of Iran*, (1975). and S. Dowlatshahi, *Capital Markets in Iran*, (Tehran: Iran Center for Management Studies Unpublished report, 1976).

Table IV-25

Growth of Liquid Assets in Iran

Billions of Current Rials

	1959		1963		1968		1973		1977	
	Amount	% of Total	Amount	% of Total	Amount	% of Total	Amount	% of Total	Amount	% of Total
Money:	39.96	80.30	57.49	67.08	105.14	58.49	278.08	50.97	822.02	43.15
- currency	(14.27)	(28.68)	(19.49)	(22.74)	(30.70)	(17.08)	(70.29)	(12.88)	(252.49)	(13.25)
- Demand Deposits	(25.69)	(51.62)	(38.00)	(44.34)	(74.44)	(41.41)	(207.80)	(38.09)	(569.53)	(29.90)
Quasi Money	9.80	19.70	28.21	32.92	74.63	41.51	267.53	49.03	1,082.85	56.85
Total	49.76	100.00	85.70	100.00	179.77	100.00	545.62	100.00	1,904.87	100.00

Source: IMF, International Financial Statistics, 1980 Yearbook, pp.226-7

Table IV-26

Growth Rates of Liquid Assets & Reserve Money in Iran, 1959-77 (Percent)

	Money (M1)	Quasi Money	Total (M2)	Reserve Money	Money Multliplier for M1	Money Multliplier for M2
1960	12.99	176.84	45.26	29.36	-12.66	12.29
1961	-14.33	-43.90	-25.43	42.61	49.29	29.95
1962	29.40	42.97	33.23	38.10	-6.30	-3.53
1963	14.87	29.64	19.34	21.96	-5.04	-1.34
1964	12.35	23.54	16.03	8.84	3.23	6.61
1965	14.77	15.29	14.95	17.24	-2.11	-1.95
1966	11.20	19.91	14.26	5.48	5.42	8.33
1967	17.52	21.92	19.14	15.69	1.58	2.98
1968	8.54	27.05	15.53	11.95	-3.05	3.19
1969	6.46	33.63	17.74	13.74	-6.40	3.52
1970	14.66	21.68	17.97	21.91	-5.95	-3.24
1971	20.72	27.47	24.00	23.98	-2.63	0.13
1972	38.34	32.17	35.26	36.74	1.17	-1.08
1973	29.75	30.86	30.29	37.21	-5.44	-5.05
1974	37.17	48.65	42.80	34.02	2.35	6.55
1975	20.13	48.77	34.75	24.80	-3.74	7.98
1976	45.78	42.44	43.90	39.22	4.72	3.36
1977	23.05	28.50	26.09	27.82	-3.74	-1.36

Source: Table IV-24 above.

2. Growth and Distribution of Credit

The large increase in capital expenditures that has been instrumental in the rapid development of the economy was made possible by the substantial increase in the amount of credit extended by the banking system to both the private and public sectors. As shown by Table IV-27, the total outstanding credit of the banking system in Iran increased from 80 billion rials in 1961 to over 2900 billion in 1977, an increase of over 26 times. During this same period, the share of total credit in GDP increased from 23 percent to almost 54 percent, implying that total credit grew faster than the growth in national income. The Table also shows that the distribution of credit between the private and the public sectors remained fairly stable, with private sector receiving an almost fixed share of 60 percent throughout the period.

The distribution of credit by the banking system among different sectors of the economy left much to be desired. In general, credit was not allocated to different economic sectors in proportion to their value added. For instance, according to Table IV-28, the agricultural sector which constituted about 21 percent of the GDP at current prices in 1968, had only 11 percent share in total private sector credit, whereas total trade with only 13.4 percent of the GDP in 1968, utilized more than 42 percent of the total credit. Construction, which constituted 5 percent, had 13.4 percent in credit, or almost three times its share of the

Table IV-27

Growth of Credit in Iran
(Billions of Rials)

	1961		1968		1973		1977	
	Amount	%	Amount	%	Amount	%	Amount	%
Credit to the Private Sector*	50.7	63.61	148.7	63.58	494.2	62.35	1868.8	64.25
Credit to the Public Sector**	29.0	36.39	85.2	36.42	298.4	37.65	1038.8	35.73
Total Credit.	79.7	100.00	233.9	100.00	792.6	100.00	2907.6	100.00

* Includes investment and equity share participation in private companies.

** Includes purchase of government securities.

Source: Central Bank of Iran, *Annual Reports and Balance Sheet*, (1972), p.148; and
______________, (1977), p.122.

Table IV-28

Distribution of Value Added & Credit in Iran
(percent)

	1968		1973		1977	
	GDP	Credit	GDP	Credit	GDP	Credit
Total Trade*	13.40	42.2	10.38	40.4	9.35	41.7
Agriculture	21.19	10.7	12.54	7.6	8.99	8.8
Industries & Mines	14.75	15.9	13.57	18.6	12.53	17.8
Construction	5.02	13.4	4.22	12.7	9.17	13.8
Others	45.64	17.8	59.29	20.7	59.96	17.9

* Comprises domestic trade and financing of exports and imports.

Source: Central bank of Iran, *Annual Reports and Balance Sheet*, (1970), p. 115; and
____________, (1975), p. 47; and
____________, (1977), p. 142.

GDP.

The two sectors to which a major part of the total credit was alloted in 1977 were domestic trade and imports. At the same time, other sectors such as exports, agriculture, and all the other productive sectors that constitute the backbone of the economy, were de-emphasized. Agriculture, among all sectors, is the most neglected in credit allocation. Lack of adequate credit and consequently investment funds have been an important factor in retarding the development of this sector.[7]

3. Price Movements

Through most of 1960's, Iran's accelerated growth was achieved with aggregate price stability according to the published official data. As shown by Table IV-29, during the Third Plan period (1963-1967) wholesale prices rose at an annual average rate of 1.51 percent while Consumer prices and GDP deflator rose at 1.52 percent and 0.61 percent respectively. Fourth Plan period (1968-1972) witnessed higher rates of price change than that of Third Plan with WPI, CPI and GDP deflator growth rates averaging 3.63 percent, 3.32 percent and 3.32 percent respectively. In 1971 inflationary pressures started to appear, and wholesale and consumer prices increased at 6.19 percent and 4.29 percent respectively over the previous year and GDP deflator rose by 7.06 percent, Table IV-30. During the Fifth Plan period

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[7] Looney (1973), op. cit., pp. 39-40.

Table IV-29

Price movements: Annual Average Changes
(percent)

	1959-62	1963-67	1968-72	1973-77	1959-77
Wholesale Price Index	1.93	1.51	3.63	12.47	5.21
Consumer Price Index	4.63	1.52	3.32	15.08	6.31
GDP deflator	1.68	0.61	3.32	26.88	8.84

Source: Table IV-30 below.

(1973-1977), however, price increases accelerated sharply to an average annual rate of 12.5 percent and 15.1 percent for WPI and CPI respectively, while the GDP deflator rose by almost 27 percent in this period (Table IV-29).

Several factors contributed to the accelerated rates of inflation during 1970-1977. Among them: increased deficit financing by the public sector in 1971 and 1972 which, however, was soon replaced by substantial surpluses due to increased oil revenues; large inflows of petro-dollars leading to an accumulation of reserves and rapid growth in money supply; buoyant private demand due to increasing money incomes (including higher civil services salaries); rising costs of imports due to world inflation of the early 1970's; rising wage and interest costs as a result of competition for available resources; and deteriorated situation of agricultural sector and consequent shortages of food. The

Table IV-30

Price Movements in Iran, (1959-1977)*

	WPI (1)	Change in WPI %	CPI (2)	Change in CPI %	GDP Deflator (3)	Change in IPD %
1959	100.00		100.00		100.00	
1960	103.30	3.30	110.00	10.00	103.22	3.22
1961	104.60	1.26	113.50	3.18	105.34	2.05
1962	105.90	1.24	114.30	0.71	105.11	-0.22
1963	106.10	0.19	114.60	0.26	105.94	0.79
1964	111.30	4.90	119.30	4.10	115.38	8.91
1965	115.10	3.41	121.70	2.01	110.19	-4.50
1966	113.80	-1.13	121.30	-0.33	108.64	-1.40
1967	114.00	0.18	123.20	1.57	107.84	-0.74
1968	114.70	0.62	124.00	0.65	109.47	1.51
1969	117.80	2.70	128.50	3.63	109.96	0.45
1970	121.20	2.89	130.50	1.56	110.62	0.60
1971	128.70	6.19	136.10	4.29	118.43	7.06
1972	136.10	5.75	144.90	6.47	126.69	6.98
1973	151.40	11.24	159.00	9.73	167.05	31.86
1974	177.10	16.97	181.80	14.34	260.16	55.74
1975	191.20	7.96	204.90	12.71	287.03	10.33
1976	208.40	9.00	228.10	11.32	335.53	16.90
1977	244.20	17.18	290.40	27.31	401.12	19.55

* Columns (1) and (2) are calculated on the basis of price indices (base=1975) and column (3) is calculated using GDP at constant 1975 prices series all given in the source (see Appendix I).

Source: I.M.F., *International Financial Statistics*, Yearbook 1980.

need to control inflation became particulaly urgent in order to protect the benefits of rapid growth and the balance of payments improvements of mid 1970's.

Attempts through price controls to accommodate the conflicting partial objective of price policy resulted, however, in price distortions: prices of transport, fuel, electricity and all basic foodstuffs were maintained low to protect urban consumers; prices of major industrial and agricultural inputs and investment goods (domestic or imported) were kept low to protect producers and encourage investors; and price support of various agricultural products was implemented to protect exporters and producers.

H. Public Sector Role in the Economy

During the period under review (1959-1977), the increasing activities of the public sector have played a large and expanding role in the growth of the Iranian economy. Central government expenditures as a percentage of GDP at current prices rose from 16 percent in 1959 to almost 45 percent in 1977 (Tables IV-1 above and IV-31). Similarly, the public sector's revenues share in gross domestic product, which was 13.6 percent of GDP in 1959 increased to 18.6 percent in 1967 and further to 37.7 percent in 1977. However, the non-oil revenues of the government (including taxes, government monopolies, foreign investment returns, custom revenues and others) which accounted for almost 6 percent of GDP in 1959 rose only to 9.9 percent of GDP by

Table IV-31

Revenues, Expenditures & Deficit of the
government of Iran, 1959-1977
(Billions of Current Rials)

	Revenues			Total Expenditures	Deficit
	Oil & Gas	Other *	Total		
1959	22.7	17.9	40.6	47.9	7.3
1960	23.6	21.8	45.4	52.6	7.2
1961	25.5	24.3	49.8	54.8	5.0
1962	26.4	23.4	49.8	54.7	4.9
1963	31.4	25.3	56.7	55.7	-1.0
1964	34.8	21.6	56.4	59.5	3.1
1965	41.5	27.6	69.1	74.7	5.6
1966	50.7	45.5	96.2	106.9	10.7
1967	54.0	53.8	107.8	136.1	28.3
1968	61.8	65.5	127.3	168.7	41.4
1969	76.4	72.7	149.1	197.2	48.1
1970	85.5	85.8	172.3	231.8	59.5
1971	155.6	103.3	258.9	291.8	32.9
1972	178.2	123.9	302.1	359.1	57.0
1973	311.3	153.5	464.8	478.0	13.2
1974	1205.2	189.2	1394.4	1254.4	-140.0
1975	1246.8	335.3	1582.1	1569.4	-12.7
1976	1421.5	414.9	1836.4	1874.0	37.6
1977	1497.8	536.5	2034.3	2422.8	388.5

* Includes: Taxes (both direct and indirect), government monopolies and affiliates, foreign investment returns, and miscellaneous.

Source: 1959-1966: UN, *Statistical Yearbook*, (1970) and (1971); and
1967-1977: Central Bank of Iran, *Annual Reports and Balance Sheet*, (1972), p. 155; and
——————, (1974), p. 144; and
——————, (1977), p. 138.

1977. This underlies the significant role of oil revenues in increasing the government revenues.

The public sector in Iran consisted (in 1959-1977) of the Central Government, various provincial and local authorities, some 130 publicly owned enterprises and nearly 60 semi-autonomous non-profit agencies.'' The Central Government was the dominant element of the public sector as many of the other elements of the public sector were dependent on central government grants to finance the major portion of their operations. In 1975, for example, the central government grants financed respectively 47 percent and 80 percent of expenditures of public enterprises and non-profit agencies.''

Table IV-31 points to some important magnitudes relating to the public sector in Iran. In this Table several important trends are worth noting at the outset. On the revenue side, the relative share of oil revenues in total government revenues steadily increased from 56 percent in 1959 to 67 percent in 1973 and further to 74 percent in 1977. Public expenditures fall into two broad categories: capital expenditures and current expenditures. The capital or development expenditures category consists of long-term investment outlays designed to promote infrastructures and the industrial capacity of the country. Current outlays

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''J. Amuzegar, *Iran: An Economic Profile*, (Washington D.C.: The Middle East Institute, 1977), p. 189.

''Plan and Budget Organization of Iran, *The Budget of Public Companies*, (Tehran: 1975), p. 14.

consist of expenditures for general defence and security, social welfare and other administrative requirements. As shown by the table, over the 19 years period covered by this study the total public sector expenditures increased substantially, from 48 billion rials in 1959 to 2423 billions in 1977, an increase of more than 50 times.

The large and rising investments undertaken by the public sector during the 1959-1977 period and the concomitant rise in current spending imposed a continuing strain on public financial resources despite the central government's growing oil and tax revenues. This strain was aggravated by the results of the government pricing policies concerning agriculture and public enterprises, which required substantial subsidies. For example, in the face of severe food shortages the government, mindful of the need to avoid discontent, implemented a food subsidy program which in 1974-1975 alone cost it 3 billion dollars (202.9 billion rials).[100] Under these circumstances, the public sector experienced a shortage of financial resources and covered its deficits partly with limited amounts of long-term external borrowing but mainly by recourse to short-term advances from the Central Bank of Iran, which has been a major factor behind price inflation. As shown by Table IV-31, the public sector deficit increased steadily from 7.3 billion rials in 1959 to 59.5 billions in 1970. The increase in oil revenues helped the government to experience, for the first time in its long history, substantial surpluses in her budget. As shown by the table, the 1974 surplus amounted to 140 billion rials. However, this did not last long and by 1976 the trend was reversed and 1977 recorded a 388.5 billion rials of deficit again.

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[100] *Economist*, "A Survey of Iran," August 28, 1976, pp. 40-43.

I. Demand Management: Policies and Problems

Through most of the 1959-1977 period, Iran carried out a reasonably effective combination of policies to regulate the growth of domestic demand as a means of constraining inflationary pressures in the economy. According to the available data, presented earlier in Table IV-30, Iran succeeded to a high degree in achieving price stability until 1970. The failure of the development plans and with the advent of the oil boom, however, the price situation deteriorated considerably. Thus, the annual rate of price increase (consumer price index), that averaged only 2.5 percent during 1959-1970 period, accelerated to an average of 12.3 percent for the 1971-1977 period. The rise in GDP deflator during the latter period was even more staggering. This index rose at an annual average rate of 21.2 during 1971-1977 period. Even so, this price behavior in Iran seems respectable enough in the face of massive public and private expenditures, universally rising import prices, and an unprecedented build up in the economy's liquidity.[101] According to Table IV-26 above, between 1971 and 1977 the money supply broadly defined (M2), increased at an annual average rate of over 35.5 percent; during the post oil boom era (1973-1977), the growth was even faster, approching 38 percent per year. In what follows we briefly describe and assess a number of measures -- that were introduced by the Iranian government to curb excessive demand pressures -- in the context of inflationary conditions peculiar to the Iranian economy.

To understand the dynamics of the inflationary process in Iran, it is important to note that a sizable part of the public sector's income has been traditionally generated outside the domestic economy. Consequently, only if this income were also spent outside the domestic economy would its impact be non-inflationary. However, as oil revenues have been used for domestic expenditures, inflationary pressure has been generated in two main ways. First, the increased public sector expenditures are an increased claim on the product of the domestic resources that has not been matched by a corresponding reduction of private sector demand. Second, these expenditures have increased the money supply, and the banking system has, thus, been able to increase its credit to both the public and private sectors. The secondary expansion of the money supply has, then, generated a further increase in aggregate demand. To the extent that the private sector has been able to use part of the increased money supply to finance more imports, the inflationary impact of the public sector expenditures has been partially offset. However, in particular sectors of the economy -- notably transportation (including port facilities), construction and power -- it has not been possible to augment the domestic supply at the desired speed, a fact that increasingly contributed to inflationary pressure in the economy. For example, the infrustructure available has been quite inadequate to the task of importing the goods ordered and in 1975 ships were waiting over 100 days at the Southern ports of Persian Gulf. Once the goods were landed, they often waited for weeks in the docks, and many decayed or corroded as a result. In 1975 alone Iran paid out $1.5 billions (101.5 billion rials), or over 7 percent of all its oil income, in demurrage charges because of delays in importing goods.[102]

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[101] See Table IV-30 above.

The foregoing analysis can best be illustrated by the use of a 'monetary analysis' of the Iranian economy. A presentation of the factors affecting changes in domestic liquidity may be worked out by employing the balance of payments and government budget identities. Such a conceptual accounting re-arrangement indicates that over most of the 19 years period of this study, the level of government net domestic expenditures had been the major determinant of the rate of monetary expansion (Table IV-32). In 1976-1977, for example, the government's net debt to the banking system in addition to the net foreign exchange receipts (oil revenues are mainly directed to the government revenues) increased by 328.69 billion rials and was the main factor responsible for the rapid growth of the money supply.

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[102] *Financial Times*, October 21, 1976.

On the basis of the preceding discussion, if the government is not prepared to curb its own appetite for domestic expenditures, yet remains concerned about inflation, then there is nothing to be done except to increase the rate of domestic taxation and/or apply monetary policies directed at restraining the further, secondary growth in money supply which the growth in monetary base helped make possible, or imposing incomes (or price control) policies.

The possibility of using tax policy to regulate the growth of domestic demand was limited by the weakness of the Iranian tax structure.[103] The tax laws and the tax reporting and collecting procedures, however, were being revised, and it was hoped that these improvements would allow tax policy to play a greater role in controlling demand in future. During the period under review, however, monetary policy has been the principal tool of the stabilization effort.

The primary monetary policy tools available in Iran include reserve requirements, discounting, mandatory government bond purchases, credit ceilings, and regulated interest rates.

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[103] Looney (1973), op. cit., Chapter 4.

Table IV-32

Factors Affecting Changes in Money and Quasi-Money

Billions of Current Rials

	1959	1963	1967	1973	1974	1975	1976	1977
A. Changes in Money and Quasi-Money	6.13	13.9	25.00	126.85	233.52	270.74	460.87	394.12
B. Changes Net Foreign Assets of The Banking System*	-2.11	1.63	3.36	4.20	475.34	41.4	3.33	216.07
C. Changes in net debt of Public Sector**	-1.27	3.62	13.07	63.86	-184.73	61.74	240.67	112.62
D. Changes in net debt of Private Sector***	9.63	9.24	13.55	103.38	111.03	257.97	302.61	181.58
E. Others****	-0.12	-0.61	-4.98	-44.59	-168.12	-90.37	-85.74	-116.15

* lines (31n) in IFS entries
** lines (32 an) and (32b) in IFS entries
*** lines (32d) in IFS entries
**** lines (36b) and (37r) in IFS entries

Source: IMF, International Financial Statistics, Yearbook 1980, pp. 226-7

Following the surge of oil revenues and public sector expenditures in 1973, the Central Bank took steps to slow the growth of domestic liquidity. Although it had no control over the injection of primary liquidity generated by public sector spending, the Central Bank sought to slow any further expansion of the money supply. Rediscount rates and interest rates on non-sight deposits (saving and time deposits) were increased by one and a half percent. Reserve requirements on sight deposits were also increased from 23 percent to 30 percent and banks were forced to purchase Treasury Bills and Bonds equivalent to 50 percent of the increase in their non-sight deposits. Finally, a 20 percent limit was placed on the growth of aggregate loans and credits to the private sector.[104]

As seen in Table IV-26 above, the measures were relatively succesful. Although the growth rate of money supply, narrowly defined (M1), slowed down from 37.2 percent in 1973-1974 to 20.1 percent in 1974-1975, it picked up momentum in 1975-1976 rising at 45.8 percent. The same happened to the growth rate of the money supply, broadly defined (M2). It slowed down from 42.8 percent in 1973-1974 to 34.8 percent in 1974-1975 and rose again at 43.90 percent during 1975-1976. In addition, the 'money multliplier', defined as the ratio of the money supply to monetary base, reversed its upward trend in response to higher reserve ratio and declined by more than 5 percent in 1973-1974. In February 1975 the Central Bank relaxed the restrictions it had imposed on the growth of credit. Reserve requirements on sight deposits were lowered from 30 percent to 25 percent and for non-sight deposits they were cut from 15 percent to 12 percent. In addition, the bank's compulsory purchases of government bonds were reduced from 50 percent to 30 percent of the increase in their non-sight deposits. The Central Bank's rediscount bills and papers were also reduced by one percent. The maximum lending rate of banks was reduced accordingly.[105] The changed policy may be attributed to three considerations. First, by allowing a more rapid expansion of credit to the private sector, a better balance between public and private sectors was hoped to be achieved. Second, to the extent that credit was directed to consumer imports, the easier credit policy was designed to ease the domestic inflationary pressure. Third, by increasing the liquidity of the commercial banks, the easier credit policy could reduce their demand for foreign loans.

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[104] Central Bank of Iran, *Annual Reports and Balance Sheet*, (1973), pp. 35-37.

The unprecedented rise in the money supply and the rising trend in prices, particularly after 1973, necessitated a further revision of the Central Bank's monetary policy. Thus in July 1975 the reserve requirements on non-sight deposits were raised again to 15 percent. Furthermore, the banks' compulsory purchases of government bonds were raised from 30 percent of increase in their non-sight deposits to 45 percent.[106]

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[105] Central Bank of Iran, *Annual Reports and Balance Sheet*, (1975), pp. 53-55.

The liberalization of foreign exchange movements added a new dimension to the Central Bank's policy of controlling the liquidity of the banking sector. In conditions of falling interest rates abroad and rising demand for credit at home it was inevitable that, faced with large reserve requirements and high interest rates, some banks turn to foreign money markets for funds. In fact, the existence of a large number of so-called 'mixed' banks with easy access to foreign capital through their foreign partners facilitated and further encouraged the process of capital inflow to Iran. Foreign exchange liberalization was also bound to reduce the importance of the rediscounting mechanism of the Central Bank as an effective instrument influencing both the level and the composition of the banking sector credit. In order to counteract these tendencies and discourage short-term capital inflows to Iran, the Central Bank imposed a 15 percent reserve requirement on the net foreign debts of banks in 1974 and raised it to 30 percent by 1976.

In conclusion, it seems clear that a better coordination of fiscal and monetary policies was crucial to a more successful regulation of aggregate demand in Iran. Without severly limiting credit to the private sector, the monetary authorities were only partially successful in their attempt to counteract the impact of large increases in public sector spending.

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[106] Central Bank of Iran, *Annual Reports and Balance Sheet*, (1976), pp. 14-15.

The incomes policy implemented in 1975, also played an important role to supplement the monetary policy in order to curb inflation. This campaign was a crude effort to brand the entrepreneur and the tradesman as the chief culprit of higher prices. In implementing this program an *adhoc* policy committee was first established in summer of 1975, made up of ministers from a number of state organizations, that had the ultimate responsibility for the program. Under the direct jurisdiction and control of this policy group, a committee was organized to investigate the cost of production of a number of products commonly consumed in Iran, and to use this information to establish official prices for commodities, products and services.

Another organization created by the authorities to deal with inflation was made up of thousands of young members of the Iran's single party at the time, the Rastakhiz Party. It was formed to seek out and report deviation from the officially set prices. At the start, it specified 640 commodities and products considered essential to consumers. This was followed by a number of additional lists of goods whose prices were established by the authorities. Those who were accused of deliquency in following posted prices were tried before the specially set up courts, which were part of the Iranian Department of Justice. Those found guilty of setting prices over the official limit received sentences ranging from suspension of their businesses, to fines, to imprisonment or a combination of those penalties. At the height of the price control action, pressures for price reductions and for moves against profiteers and hoarders occured in all areas and at all levels of the manufacturing-distribution chain, as well as in every sector of the commercial-industrial establishment. Managing directors of nationally known companies, small merchants, street vendors, and government officials were taken to courts for price violations.[107]

The program reached its peak in the winter of 1976, and then seemed to move out quickly from the public scene. As a whole the price campaign was a failure. Official indices went down for about six months but black-market prices for essential commodities rose sharply. The shortages were not relieved, and if anything became more pronounced. Importers decided in many instances that if controls were to be imposed on profit margins of products, it was more economical for them not to import at all. The same applied to local manufacturers. Many of them, among the most efficient ones, closed down, never to reopen again.[108]

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[107] V. R. Vicker, "Caveat Vendor-Merchants in Iran Face Citizen Army of Price Policemen," *Wall Street Journal*, October 5, 1976.

[108] Graham (1978), op. cit., p. 96.

J. Summary

In this chapter we have tried to present a general introduction to the Iranian economic conditions and policies implemented during the 1959-1977 period. Our central concern has been to provide some background against which to develop in subsequent chapters an analysis of inflation in the Iranian economy. In this final section of the chapter we can briefly pause to review the main points of the discussion.

In brief, we have seen that the Iranian economy has exemplified to an extreme degree the dual process of growth and rapid structural change. Since 1959 the real output of the country's productive resources (GDP) increased by over 4 times, indicating an average annual growth rate of almost 9 percent between 1959 and 1977.

The major factor underlying the country's growth performance seems to have been the accelerated increase in the volume and the value of oil exports. Throughout the period under study, the oil sector has accounted for between 16 to 30 percent of the GDP. In a more direct way, the oil sector has assisted the rapid development of the economy by providing an ample supply of foreign exchange to draw on for financing increasing amounts of imports. It has also facilitated substantial foreign borrowing by the main domestic sectors (especially the government and the banking sectors) through enhancing their credit-worthiness in the foreign capital markets. In short, the oil sector has helped remove the foreign exchange bottleneck constraining the growth of the many other less developed countries. The economic growth has also received major stimulus from the public sectors' massive oil-financed expenditures.

Although the growth of the economy over the 1960's has been achieved amidst price and foreign exchange stability, strong inflationary pressures appeared in early 1970's and were intensified by mid 1970's, the GDP deflator rose by an average annual rate of more than 21 percent between 1970 and 1977.

Given the limited scope for tax policy in Iran, we have seen that monetary policy has been the principal stabilization tool used in the country. The use of a host of monetary instrument by the Central Bank -- reserve requirements, discount rates, deposit rate ceilings, mandatory bond purchases, etc. -- has been relatively successful in regulating the growth of domestic demand and, hence, in stemming inflationary pressures in the economy. With the emphasis in oil revenues after 1973, however, the price situation considerably deteriorated, reflecting the growing inefficiency of monetary policy in curbing excess demand inflationary pressures in the absence of cooperation from fiscal authorities -- in the form of controlling the growth of public expenditures and/or imposing higher taxes. The need for better coordination between monetary and fiscal policies is recognized, and a reassessment of expenditure plans should be made.

V. A MODEL OF INFLATION FOR IRAN

In this chapter, a theoretical analysis of a simultaneous equation model of inflation in Iran is undertaken. An attempt will be made to formulate a basic integrated model of inflation which embraces both the structuralist and the monetarist analysis of inflation talked about earlier in Chapter III. The basic structural literature concentrates on an implicit three sector model namely: agriculture, domestic industry and foreign trade sectors; while the monetarist literature hypothesises and tries to show how the rate of change of prices, the money stock, and the government deficit are all interrelated. Our model then will be used to explain the structure which transmits changes in the data through to the price index that is used to measure inflation and the testable implications of the model.

The basic model developed for this study consists of eleven equations and three identities which determine simultaneously the rates of change of the relative price of food, agricultural prices, industrial prices, wage rates, general price level; real income, expected rate of inflation, money supply, government deficit, government expenditures, government revenues, imports, balance of payments, and unemployment rate.

We begin by outlining the relationships of the model and by explaining the notations to be used.

The Model:

$$(\dot{F}/F) = f_0 + f_1[(1-c)(\dot{N}/N) + c(\dot{Y}/Y) - A]$$

$$f_1>0 \tag{1}$$

$$(\dot{P}a/Pa) = (\dot{F}/F) + (\dot{P}i/Pi) \tag{2}$$

$$(\dot{P}i/Pi) = i_1[(\dot{W}/W)-(\dot{I}/I)] + i_2(\dot{P}z/Pz) + i_3(\dot{C}u/Cu)$$

$$i_1>0,\ i_2>0,\ i_3<0 \tag{3}$$

$$(\dot{W}/W) = w_0 + w_1U + w_2\pi + w_3(\dot{P}z/Pz) + w_4(\dot{S}/S)$$

$$w_1<0,\ 0<w_2\leq 1,\ w_3>0,\ w_4>0 \tag{4}$$

$$(\dot{P}/P) = b_1(\dot{F}/F) + (\dot{P}i/Pi)$$

$$0<b_1<1 \tag{5}$$

$$\text{Log}(Y) = -a_0/a_1 + 1/a_1\text{Log}(M) - 1/a_1\text{Log}(P) - a_2/a_1\pi$$

$$a_1>0,\ a_2<0 \tag{6}$$

$$\Delta\pi = \theta[\Delta\text{Log}(P) - \pi_{-1}]$$

$$0<\theta\leq 1 \tag{7}$$

$$\text{Log}(M) = m_0 + m_1\text{Log}(D+e_1) + m_2\text{Log}(BP+e_2) + \text{Log}(M)_{-1}$$

$$m_1>0,\ m_2>0 \tag{8}$$

$$D = G - R \tag{9}$$

$$\text{Log}(G/P) = \delta g_0 + \delta g_1\text{Log}(Y) + (1-\delta)\text{Log}(G/P)_{-1}$$

$$g_1>0,\ 0<\delta<1 \tag{10}$$

$$\text{Log}(R) = \eta r_0 + \eta r_1\text{Log}(YP) + (1-\eta)\text{Log}(R)_{-1}$$

$$r_1>0,\ 0<\eta<1 \tag{11}$$

$$BP = X.Px + Xoil.Poil - Z.Pz + K \tag{12}$$

$$\text{Log}(Z) = \mu z_0 + \mu z_1\text{Log}(Y) + \mu z_2\text{Log}(Pz/P) + (1-\mu)\text{Log}(Z)_{-1}$$

$$z_1>0,\ z_2<0,\ 0<\mu<1 \tag{13}$$

$$U = u_0 + u_1[\text{Log}(Y) - \text{Log}(\bar{Y})]$$

$$u_1>0 \tag{14}$$

and the variables are:

Endogenous Variables:

P = Index of general price level

Pa = Index of prices in agricultural sector

Pi = Index of prices in industrial sector (non-agriculture)

F = Relative price of food (Pa/Pi)

W = Index of money wage earning in industrial sector

Y = Real income (at 1959 prices)

π = Expected rate of inflation

M = Total stock of money supply

D = Domestic government budget deficit (nominal)

G = Domestic government expenditures (nominal)

R = Domestic government revenues (nominal)

BP = Balance of payments surplus

Z = Volume of imports

U = Unemployment rate

Predetermined Variables:

A = Trend rate of growth of output in agricultural sector

N = Population

I = Real output per-person in industrial sector (at 1959 prices)

Cu = Index of capacity utilization

S = Index of demand shift

X = Volume of non-oil exports

Xoil = Volume of oil exports

K = Net capital flows (balance of payments on capital account)

Px = Prices of non-oil exports in domestic currency

Poil = Prices of oil exports in domestic currency

Pz = Prices of imports in domestic currency

$\overline{Y}$ = Full-employment level of real income

and four lagged dependent variables; M_{-1} , G_{-1} , R_{-1} and Z_{-1} .

We shall now discuss each relationship of the model one by one.

Equation 1:

$$(\dot{F}/F) = f_0 + f_1[\ (1-c)(\dot{N}/N) + c(\dot{Y}/Y) - A\ ]\ ;\ f_1>0$$

The idea behind this relationship is that, in a less developed economy like Iran, the agricultural sector finds it impossible to meet the demands for additional output which are imposed by growth of population and rising income and, thus, economic growth is bound to be accompanied by rising relative agricultural prices. To develop this idea we consider the following structural model of food pricing.[100]

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[100] See: Meuller (1965), "Structural Inflation and the Mexican Experience," op. cit.; Edel (1969), *Food Supply and Inflation in Latin America*, op. cit.; and Argy (1970), "Structural Inflation in Developing Countries," op. cit.

The model formulated is a simplified one in that it uses and considers the total demand for and supply of all food together. In addition, factors such as income distribution, property ownership and urbanization rate do not appear explicitly in the model since due to lack of data their empirical verification is not possible; they may be considered to affect the parameters used in the model.

Supply Side

The rate of change of supply of food may be considered as a function of relative price of foodstuffs and a trend rate at which production of food would increase even if the relative prices were constant. This trend rate (A) is expected to be positive because of the adoption of new techniques, organizational change, increase in population and labor force or increase in the area cultivated. Then, we can write:

$$(\dot{Q}s/Qs) = A + b_1(\dot{F}/F) \qquad \text{(I)}$$

where:

$\dot{Q}s/Qs$ = Rate of growth of food supply;

A = Trend rate of change of food production;

$\dot{F}/F$ = Rate of change of relative price of food, F = Pa/Pi;

b_1 = Price elasticity of food supply.

Demand Side

The rate of growth of demand for food is given by a function of rates of change of relative prices, real per-capita income and population. Effects of changes in taste, urbanization rate and distribution of income which are correlated with the growth of income will affect the value of income elasticity of demand (c) which is defined in relation to total income rather than the disposable income. We then can write:[110]

$$\dot{Q}d/Qd = \dot{N}/N + c\dot{y}/y - b_2\dot{F}/F \qquad \text{(II)}$$

where:

$\dot{Q}d/Qd$ = Rate of growth of demand for food;

$\dot{y}/y$ = Rate of growth of real per-capita income, $y = Y/N$;

c = Income elasticity of demand for food;

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[110] To derive the demand equation (II) below the following steps are taken. Assuming:

$\dot{q}/q$ = rate of growth of individual demand for food, and

$\dot{y}/y$ = rate of growth of per-capita real income,
we can write:

$$\dot{q}/q = c\dot{y}/y - b_2\dot{F}/F$$

where:

$q = Q/N$, $y = Y/N$, and $F = Pa/Pi$

then:

$$\dot{Q}/Q - \dot{N}/N = c\dot{y}/y - b_2\dot{F}/F$$

or

$$\dot{Q}/Q = \dot{N}/N + c\dot{y}/y - b_2\dot{F}/F$$

which is our demand equation.

b_2 = Price elasticity of demand for food with sign defined to be positive if an increase in price decreases demand.

Given the assumptions of linear functions, if the market is to be cleared with no change in relative prices, such that:

$$Qs = Qd$$

$$\dot{Q}s/Qs = \dot{Q}d/Qd$$

$$\dot{F}/F = 0$$

solving for the trend rate of growth of food production (A) gives a value which may be interpreted -- following Edel (1969)''' -- as the rate of food production 'required' for relative price stability (A*), that is:

$$A^* = \dot{N}/N + c\dot{y}/y \qquad \text{(III)}$$

If the trend growth rate is not sufficient, that is if '$A<A^*$', then the deficiency in food production will cause an increase in the relative price of food. That is, allowing the relative price of food to vary, and if '$Qs=Qd$' and '$\dot{Q}s/Qs=\dot{Q}d/Qd$', then:

$$\dot{F}/F = [\dot{N}/N + c\dot{y}/y - A]/[b_1 + b_2] \qquad \text{(IV)}$$

or

$$\dot{F}/F = (A^* - A)/(b_1 + b_2)$$

Equation IV points to a direct relationship between the rate of relative price increase on the one hand and the

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'''Edel (1969), *Food Supply and Inflation in Latin America*, op. cit.

population growth as well as the rate of growth of per-capita real income and income elasticity of demand for food on the other. That is, the higher the income elasticity of demand for food and the rate of growth of per-capita real income as well as the greater the rate of growth of population, the higher would be the rate of increase of price relative. And, the higher the trend rate of growth of food production (A), the lower the rate of increase of relative price of food. Smaller price adjustments would be required the greater price elasticities of supply (b_1) and demand (b_2) are. A modified version of equation IV, by substituting for the rate of change of real per-capita income from:

$$\dot{y}/y = \dot{Y}/Y - \dot{N}/N$$

constitutes the first equation of our model.

The inadequate supply of agricultural product hypothesis can be shown, using the above model, by an inadequate trend rate of increase of food production -- that is '$A<A*$'. This may be interpreted as the failure of the short-run supply curve to shift to the right as fast as the demand curve does.

In order to test for the adequacy or inadequacy of agricultural supply we center our analysis on the derived equation III for the 'required' rate of increase of production for stable relative prices:

$$A* = \dot{N}/N + c\dot{y}/y$$

To estimate the value of 'A*' we require an estimate of income elasticity of demand for food, 'c'. A number of estimates of the income elasticity of demand for food can be found in the literature. Houthakker (1957)[112] argues that the typical partial income elasticity of expenditures on food in less developed countries is about 0.6. Seers (1964)[113] estimated the income elasticity of demand for food over time assuming that the observed per-capita income elasticity of expenditures on food, not corrected for price increases, will approximate the elasticity net of price increases in open economies in which imports can correct for insufficient domestic production. He comes up with figures of 0.4 and 0.5 for less developed countries. Maynard (1961)[114] reports an income elasticity of demand for food equal to 0.6 for Latin American countries without stating explicitly its statistical derivation.

For Iran, using the United Nations data on per-capita food consumption (calories per day), as well as figures on per-capita income and relative food prices the following regression would be employed to derive the income elasticity of demand:

$$Q = a_0 + a_1F + a_2y$$

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[112] H. S. Houthakker, "An International Comparison of Household Expenditures Commemorating the Centenary of Engel's Law," *Econometrica*, XXV, (1957), pp. 532-51.

[113] D. Seers, "Normal Growth and Distortions: Some Techniques of Structural Analysis," *Oxford Economic Papers*, XVI, (1964), pp. 78-104.

[114] G. Maynard, "Inflation and Growth: Some Lessons to be drawn from Latin American Experience," *Oxford Economic Papers*, XIII, (1961), pp. 184-202.

where:

Q = Daily per-capita food consumption in calories;

F = Relative price of food;

y = Per-capita real income.

We can evaluate the income elasticity of demand for food by evaluating it at the mean income and mean consumption level, that is:

$$c* = a_2*(\bar{y} / \bar{Q})$$

where 'c*' and 'a_2*' are estimated values of 'c' and 'a_2' respectively. It should be noted that the elasticities measuring food in caloric terms might be expected to be lower than the elasticities measuring food in value terms, because the consumer who is faced with an increase in income or a decline in price will switch from cheaper to higher quality foodstuffs of the same caloric content as well as increasing his consumption of calories.

Using this estimate of income elasticity (c*) as well as other income elasticities reported in the literature for less developed countries, we can determine the value of the required rate of food production for price stability (A*) using equation III above. The statistics on the rates of growth of per-capita real income and population will also be utilized. The value of 'A*' determined is that trend rate at which production of food would have to increase in order to satisfy demand with no changes in the relative price of foodstuffs.

The calculated required growth rates could then be compared with figures giving the rates of growth of food or agricultural production (adjusted for change in price) in order to come up with some ideas about the relative adequacy of production in Iran for different periods.

The trend rates of growth of food production -- that is, actual growth rates adjusted for price changes -- could be estimated by regressing the supply of agricultural production on current and past rates of relative price changes.

$$(\dot{Q}s/Qs) = b_0 + b_1(\dot{F}/F) + b_2(\dot{F}/F)_{-1} + e_1$$

Then, the sum of of estimated 'b_0' and 'e_1' ($b_0{*}+e_1{*}$) would represent the trend rates of growth of agricultural production 'A'; that is the rate which has been adjusted for any relative price effects on production of foodstuffs.

The next task is to relate the 'relative' price in the agricultural sector (F) to the 'absolute' price 'Pa' of that sector.

Relationship Between Relative and Absolute Prices in Agriculture

In order to link the 'relative' price in the agricultural sector to the 'absolute' price of that sector and show that they move in the same direction -- that is, any rise in the level of relative agricultural prices will lead to inflation -- use is made of Enthoven's (1956)[115] article.[116] Akerlof (1969)[117] and recent articles by Pitchford (1977)[118] and Turnovsky (1979)[119] have developed a two-sector model of inflation which shows that the relative price is important in the mechanism of inflation. Akerlof analyses a model in which the two sectors are non-competitive. Both Pitchford and Turnovsky examine a model of inflation for two forms of industry structure; one prices according to competitive and the other according to non-competitive norms. However, for our purpose, the Enthoven's model is more appropriate and we follow his line of analysis.

First, we will show, under reasonable assumptions, that the price level depends not only on the level of excess aggregate demand but on the composition of aggregate demand as well. Second, a price reaction equation is defined in line with Enthoven's. Finally, employing the Laspeyres price index, the necessary and sufficient conditions for the rise in the price level is derived.

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[115] A.C. Enthoven, "Monetary Disequilibria and the Dynamics of Inflation," *Economic Journal*, (June 1956), pp. 256-70.

[116] Parts of this section draws on: Susan M. Wachter, *Latin American Inflation*, (Toronto: D.C. Heath and Company, 1976), Chapter 1.

[117] G. A. Akerlof, "Relative Wages and the rate of Inflation," *Quarterly Journal of Economics*, 83, (1969), pp. 353-74.

[118] J. D. Pitchford, "Expectations and Income Claims in a Two-Sector Model of Inflation," *Canadian Journal of Economics*, (November 1977), pp. 637-52.

[119] S. J. Turnovsky, "Inflationary Expectations in a Two-Sector Model of Wage-Price Determination," *Oxford Economic Papers*, (March 1979), pp. 1-19.

By Walras' Law, the monetary excess demand for all goods is equal to excess supply of money, that is:

$$\sum_{i=1}^{m} P_i X_i = - X_{m+1} \qquad \text{(V)}$$

where:

P_i = Price of ith good,

X_i = Excess demand for ith good,

X_{m+1} = Excess demand for money,

P_{m+1} = Price of money = 1.

Excess demand functions can be written as follows:

$$X_i = X_i(P_1, \ldots, P_m; \pi_1, \ldots, \pi_m; W) \qquad \text{(VI)}$$

where:

π_i = Expected price of ith good,

W = Level of wealth.

By definition, when there is excess aggregate demand we can write:

$$\sum_{i=1}^{m} P_i X_i > 0 \qquad \text{(VII)}$$

Inequality VII is defined as the Keynes-Hansen condition for the existence of inflationary pressure by Enthoven.[120] By introducing a price reaction equation we are able to show that in addition to excess aggregate demand, the composition of aggregate demand is responsible for the inflationary pressure.

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[120] Enthoven (1956), op. cit., p. 263.

The Price Reaction Equation:

Using Enthovens' price reaction equation:[121]

$$\dot{P}_i / P_i = K_i X_i / Qs_i = K_i [(Qd_i - Qs_i)/Qs_i] \qquad \text{(VIII)}$$

where:

K_i = Price reaction coefficient,

Q_i = Quantity demanded (d) or supplied (s).

Equation VIII shows that the rate of change in the price of ith good is directly proportional to the excess demand for good 'i' expressed as a fraction of the quantity supplied (Qs).[122] It is not clear whether Enthoven has assumed that 'K's' are constant over time or they are constant across sectors or both. However, we should point out that, firstly, 'K's' in our model are defined at the same time period that the demand and supply are defined. Secondly, the response of prices to the composition of excess demand, that is 'K's', do depend on the price elasticities of demand and supply.

Necessary and Sufficient Conditions for A Rise in the Level of Prices:

The Laspeyres price index is:[123]

$$P_L = [\sum_i P_i \bar{Q}_i] / [\sum_i \bar{P}_i \bar{Q}_i] \qquad \text{(IX)}$$

where:

$\bar{P}_i$ = Price of the ith good in the base period,

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[121] Ibid., p. 262.

[122] Patinkin (1965) has also derived this equation using Walras' theory of *tatonnement*. See D. Patinkin, *Money, Interest, and Prices*, (New York: Harper and Row, 1965), p. 249 and pp. 485-6.

[123] C. F. Fergusen, *Microeconomic Theory*, (Homewood: Irwin, 1972), pp. 81-82.

$\bar{Q}_i$ = Quantity of the ith good in the base period,

P_i = Current price of ith good.

Differentiating the Laspeyres index with respect to time:

$$\dot{P}_L = [\sum_i \bar{Q}_i \dot{P}_i] / [\sum_i \bar{Q}_i \bar{P}_i] \qquad \text{(X)}$$

Substituting from the price reaction equation VIII:

$$\dot{P}_L = [\sum_i \bar{Q}_i P_i K_i (X_i / Qs_i)] / [\sum_i \bar{Q}_i \bar{P}_i]$$

or

$$\dot{P}_L = [\sum_i P_i K_i X_i] / [\sum_i \bar{Q}_i \bar{P}_i] \qquad \text{(XI)}$$

where for simplicity we have assumed that '$\bar{Q}_i = Qs_i$'.

For the price level to rise -- that is, $\dot{P}_L > 0$ -- the numerator of equation XI must be positive since its denominator is positive. That is:

$$\sum_i K_i P_i X_i > 0 \qquad \text{(XII)}$$

If price reaction coefficients for all sectors (K's) were the same, the Keynes-Hansen condition would be fulfilled. That is:

$$K_i = K > 0$$

$$K \sum_i P_i X_i > 0$$

$$\sum_i P_i X_i > 0$$

But if 'K's' differ between sectors, the price level would be affected by not only the level of excess aggregate demand but its distribution among sectors as well.

The economic significance of XII is that:

> ... a situation can be characterized as inflationary when monetary excess demands are concentrated in sectors which are important in terms of the sensitivity of their prices to excess demands, and hence, which are likely to affect the Laspeyres price index. Excess demands in flexible price sectors receive larger weights than they do in

> relatively rigid price sectors, for they are potentially more significant for the price level. Sectors with rigid prices receive little or no weights for they are not apt to be of great importance from the point of view of inflation. Thus [XII] makes allowance for institutional facts of imperfect competition, lags in adjustment and price rigidities.'[124]

Dividing the economy into two sectors '1=agriculture' and '2=non-agriculture', the Laspeyres price index will be:

$$P_L = [\bar{Q}_1 P_1 + \bar{Q}_2 P_2] / [\bar{Q}_1 \bar{P}_1 + \bar{Q}_2 \bar{P}_2] \qquad \text{(XIII)}$$

and:[125]

$$\dot{P}_L = [\bar{Q}_1 \dot{P}_1(t) + \bar{Q}_2 \dot{P}_2(t)] / [\bar{Q}_1 \bar{P}_1 + \bar{Q}_2 \bar{P}_2] \qquad \text{(XIV)}$$

Using the price reaction equation (VIII) and substituting for '$\dot{P}_1$' and '$\dot{P}_2$' in XIV and assuming that '$\bar{Q}_i = Qs_i$', then:

$$\dot{P}_L = [K_1 P_1 X_1 + K_2 P_2 X_2] / [\bar{Q}_1 \bar{P}_1 + \bar{Q}_2 \bar{P}_2] \qquad \text{(XV)}$$

Structuralist theory of inflation assumes that the prices in agricultural sector react more intensely than the prices in the rest of the economy. This means that, the price reaction coefficient in agricultural sector 'K_1' is greater than the reaction coefficient of the non-agricultural sector 'K_2', that is '$K_1 > K_2$'.

If '$P_1 X_1 = -P_2 X_2$' and if '$K_1 > K_2$', then '$\dot{P}_L$' in XV would be positive. This means that the general price level will

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[124] Enthoven (1956), op. cit., p. 266.

[125] To derive equation XIV below:

$$\dot{P}_L = P_L(t) - P_L(t-1)$$

$$\dot{P}_L = [(\bar{Q}_1 P_1(t) + \bar{Q}_2 P_2(t)) / (\bar{Q}_1 \bar{P}_1 + \bar{Q}_2 \bar{P}_2)] - [(\bar{Q}_1 P_1(t-1) + \bar{Q}_2 P_2(t-1)) / (\bar{Q}_1 \bar{P}_1 + \bar{Q}_2 \bar{P}_2)]$$

or

$$\dot{P}_L = [\bar{Q}_1 \dot{P}_1(t) + \bar{Q}_2 \dot{P}_2(t)] / [\bar{Q}_1 \bar{P}_1 + \bar{Q}_2 \bar{P}_2].$$

rise even if there is no excess of aggregate demand in the economy.

Assuming that excess demand is positive and equal to 'a', that is:

$$P_1X_1 + P_2X_2 = a \qquad \text{(XVI)}$$

solve for 'P_2X_2' from XVI and substitute in XV we get:

$$\dot{P}_L = [(K_2a) / (\bar{Q}_1\bar{P}_1 + \bar{Q}_2\bar{P}_2)] +$$
$$[(\ (K_1-K_2)P_1X_1\ ) / (\bar{Q}_1\bar{P}_1 + \bar{Q}_2\bar{P}_2)] \qquad \text{(XVII)}$$

Equation XVII specifies that the rate of change in the general price level depends on the level of excess demand 'a' as well as the distribution of excess demand between the two sectors if '$K_1 \neq K_2$'.

The structuralist argument of inelastic supply of food -- that as a result of a backward agricultural sector the price of foodstuffs rises inevitably whenever the demand for food expands due to rapid expansion of population, rise in per-capita income and increase in urbanization -- can be put forward in order to assume that '$K_1>K_2$'. This means that prices react more intensely in agriculture than elsewhere. Then, for any given level of excess aggregate demand, the greater the value of excess demand in agriculture the greater is the over all price increase.

Now, in order to find the relation between 'relative' agricultural prices and excess demand, we start with the definition of relative price of agricultural product.

$$F = P_1/P_2$$

and

$$\dot{F}/F = \dot{P}_1/P_1 - \dot{P}_2/P_2 \qquad \text{(XVIII)}$$

Using the price reaction equation (VIII):

$$\dot{F}/F = (K_1X_1/Qs_1) - (K_2X_2/Qs_2) \qquad \text{(XIX)}$$

Substituting for 'X_2' from XVI into XIX:

$$\dot{F}/F = (K_1/Qs_1 + K_2P_1/Qs_2P_2)X_1 - (K_2a/Qs_2P_2) \qquad \text{(XX)}$$

setting:

$$B = 1 / (K_1/Qs_1 + K_2P_1/Qs_2P_2)$$

$$C = (K_2/Qs_2P_2) / (K_1/Qs_1 + K_2P_1/Qs_2P_2)$$

where both 'B' and 'C' are positive. We can rewrite XX as:

$$\dot{F}/F = (1/B)(X_1) - (C/B)a \qquad \text{(XXI)}$$

or:

$$X_1 = B(\dot{F}/F) + Ca \qquad \text{(XXII)}$$

Equation XXI points out to a positive relation between 'X_1' and '$\dot{F}/F$', that is between excess demand in agriculture and the rate of change of relative prices in agricultural sector. The larger is 'X_1' the larger '$\dot{F}/F$' would be.

Our final task is to to relate the rate of change of relative agricultural prices to the rate of inflation. To do so, we substitute equation XXII into equation XVII:

$$\dot{P}_L = [(K_2 + CP_1(K_1-K_2))/ (\bar{Q}_1\bar{P}_1 + \bar{Q}_2\bar{P}_2)]a + [((K_1-K_2)P_1B) / (\bar{Q}_1\bar{P}_1 + \bar{Q}_2\bar{P}_2)](\dot{F}/F) \qquad \text{(XXIII)}$$

Divide both sides of XXIII by 'P_L' to define the rate of inflation, '$\dot{P}_L/P_L$':

$$\dot{P}_L/P_L = [(K_2 + CP_1(K_1-K_2))/ P_L(\bar{Q}_1\bar{P}_1 + \bar{Q}_2\bar{P}_2)]a + [((K_1-K_2)P_1B)/P_L(\bar{Q}_1\bar{P}_1 + \bar{Q}_2\bar{P}_2)](\dot{F}/F) \qquad \text{(XXIV)}$$

Substitute for 'P_L' on the right hand side of XXIV from

XIII, we get:

$$\dot{P}_L/P_L = [(K_2 + CP_1(K_1-K_2))/(\bar{Q}_1P_1 + \bar{Q}_2P_2)]a + [((K_1-K_2)P_1B)/(\bar{Q}_1P_1 + \bar{Q}_2P_2)](\dot{F}/F) \qquad \text{(XXV)}$$

The value of coefficient of '$\dot{F}/F$' in equation XXV is positive, negative or zero depending on whether 'K_1' is greater, smaller or equal to 'K_2' respectively. If structuralist hypothesis concerning '$K_1>K_2$' holds, then the rate of inflation moves with the rate of change in the relative price in agriculture. Therefore, according to equation XXV, the rate of inflation varies directly with the relative prices as well as the excess aggregate demand or absolute prices.

Equation 3:

$$(\dot{P}i/Pi) = i_1[(\dot{W}/W)-(\dot{I}/I)] + i_2(\dot{P}z/Pz) + i_3(\dot{C}u/Cu) \ ; \quad i_1>0,\ i_2>0,\ i_3<0$$

This equation expresses the mark-up price equation in the industrial sector of the economy. To derive this relationship we pursue the price determination in the mark-up sector of the economy.

The expression for the mark-up sector can be written as:[124]

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[124] The derivation of this price equation follows that of: A. K. Dasgupta and A. J. Hagger, *The Objectives of Macroeconomic Policy*, (London: Macmillan, 1971), Chapter 9.

In a mark-up model, price is determined in the following way:

$$\dot{Pi}/Pi = \dot{m}/m + \dot{c}/c \qquad (I)$$

where:

$\dot{Pi}/Pi$ = Rate of change of index of industrial prices,

$\dot{m}/m$ = Rate of change of some index of mark-up factor,

$\dot{c}/c$ = Rate of change of some index of unit cost in the mark-up sector.

'$\dot{c}/c$' can be further decomposed into:

$$\dot{c}/c = i_1(\dot{n}/n) + i_2(\dot{r}/r) \qquad (II)$$

where:

$\dot{n}/n$ = Rate of change in index of unit labor cost in the mark-up sector,

$\dot{r}/r$ = Rate of change in index of unit non-labor cost in the mark-up sector.

Note that '$i_1+i_2=1$'.[127]

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[126] (cont'd) $Pi = c + xc = (1+x)c = mc$
where 'c' is unit cost, the term 'xc' is the profit margin and '$m=(1+x)$' is the mark-up factor. The fraction 'x' is referred to as the 'relative' profit margin because it represents the profit margin (price minus unit cost) expressed as a proportion of unit cost. That is:

$$x = (Pi - c)/c.$$

[127] Assuming that unit cost of a price maker is 'c', while 'n' is the unit labor cost and 'r' is the unit non-labor cost, we can write:

$$c_0=n_0+r_0, \text{ and } c_1=n_1+r_1$$

where subscripts '0' and '1' refer to successive periods. Then:

$$[(c_1-c_0)/c_0]=[(n_1+r_1)-(n_0+r_0)]/[n_0+r_0]$$

or:

$$[(c_1-c_0)/c_0]=[(n_1-n_0)/n_0][n_0/(n_0+r_0)]+ [(r_1-r_0)/r_0][r_0/(n_0+r_0)]$$

or:

$$\dot{c}/c = i_1.\dot{n}/n + i_2.\dot{r}/r$$

In addition '$\dot{n}/n$' in equation II can be decomposed into two parts, that is:

$$\dot{n}/n = \dot{W}/W - \dot{I}/I \qquad \text{(III)}$$

where:

$\dot{W}/W$ = Rate of change of index of money wage earning in the mark-up sector,

$\dot{I}/I$ = Rate of change of real output per-person in the mark-up sector.

Substituting III into II we get:

$$\dot{c}/c = i_1(\dot{W}/W - \dot{I}/I) + i_2(\dot{r}/r) \qquad \text{(IV)}$$

and substitute IV into I:

$$\dot{Pi}/Pi = i_1(\dot{W}/W - \dot{I}/I) + i_2(\dot{r}/r) + (\dot{m}/m) \qquad \text{(V)}$$

According to equation V, the rate of change in the index of mark-up prices (Pi) can be approximated by taking a weighted sum of the rate of change of money wage earning per-person in the mark-up sector (weight=i_1), the rate of change of real output per-person in the mark-up sector (weight=$-i_1$), the rate of change of unit non-labor cost in the mark-up sector (weight=i_2), and the rate of change of the mark-up factor in that sector (weight=1).

Assuming that profit margins in the industrial sector are constant ($\dot{m}/m=0$) and using price of imports in domestic currency (Pz) as a proxy for the index of non-labor cost in the industrial sector (r), the mark-up price equation (V)

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[27](cont'd)where:
$i_1 = n_0/(n_0+r_0)$
$i_2 = r_0/(n_0+r_0)$
and '$i_1+i_2=1$'.

for the whole economy can be rewritten as:

$$\dot{P}i/Pi = i_1(\dot{W}/W - \dot{I}/I) + i_2(\dot{P}z/Pz) \qquad \text{(VI)}$$

This derivation of the pricing equation in the mark-up sector of the economy is the simplest possible. It could be a reasonable representation of pricing behavior in the oligopolistic sectors of the economy but, it is not an adequate description of price determination in the competitive sector. Equation VI ignors any demand effects which play an important role in price determination in this sector.

To come up with a more complete price equation Siebert and Zaidi (1971),[128] Askin and Kraft (1974),[129] Scarfe (1977)[130] and Turnovsky (1977)[131] have included a measure of excess product demand -- such as the degree of capacity utilization; a measure of inventory disequilibria; or the deviation between actual output and fullemployment output -- in the price equation.

In our study, as a first approximation, we replace equation VI with the following:

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[128] C. D. Siebert and M. A. Zaidi, "The Short-Run Wage-Price Mechanism in U. S. Manufacturing," *Western Economic Journal*, (September 1971), pp. 278-88.

[129] A. B. Askin and J. Kraft, *Econometric Wage and Price Models*, (London: Lexington Books, D. C. Heath and Company, 1974).

[130] B. L. Scarfe, *Cycles, Growth, and Inflation: A Survey of Contemporary Macro-Dynamics*, (New York: McGraw Hill, 1977), Chapter 11.

[131] S.J. Turnovsky, *Macroeconomics Analysis and Stabilization Policy*, (Cambridge: Cambridge University Press, 1977), chapters 5 and 12.

$$(\dot{P}i/Pi) = i_1[(\dot{W}/W)-(\dot{I}/I)] + i_2(\dot{P}z/Pz) + i_3(\dot{C}u/Cu) \qquad \text{(VII)}$$

where 'Cu' is the index of capacity utilization defined as the ratio of the index of production to the index of capacity. A number of arguments have been made as to the sign of 'i_3'. Siebert and Zaidi (1971) and Askin and Kraft (1974) argue that the rate of change of capacity utilization $(\dot{C}u/Cu)$ may be used as a proxy for the price lowering impact that an expansion of demand has by lowering unit costs.[132] The change in capacity utilization variable represents movements down the short-run cost curve.[133] Because of the quasi-fixed nature of labor, the short-run cost curve in a fluctuating economy declines much more rapidly than the long-run curve. Labor is quasi-fixed for the costs of hiring, training, and laying off as well as uncertainty as to the permanency of the new levels of demand.[134] These mean that:

> An expansion in the demand for its product can affect the price decision of a firm ... in the short-run. ... unit costs tend to decline as more

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[132] See also: J. Derez and E. Sheshenski, "Demand Fluctuations, Capacity Utilization, and Costs," *American Economic Review*, (December 1976).

[133] Siebert and Zaidi (1971), op. cit., p. 282.

[134] For a discussion on the quasi-fixed nature of labor see: F. Brechling, "The Relationship Between Output and Employment in British Manufacturing Industries," *Review of Economic Studies*, (July 1963), pp. 187-216; W. Y. Oi, "Labor as a Quasi-Fixed Factor," *Journal of Political Economy*, (December 1962), pp. 538-56; and T. A. Wilson and O. Eckstein, "Short-Run Productivity Behavior in U. S. Manufacturing," *Review of Economics and Statistics*, (February 1964), pp. 41-54.

> effective use is made of factor inputs, including labor, which are of a quasi-fixed nature.[135]

Therefore, they expect the coefficient of the rate of change of capacity utilization (i_3) to be negative.

Equation VII constitutes 'equation 3' of our model.

Equation 4:

$$(\dot{W}/W) = w_0 + w_1 U + w_2 \Pi + w_3 (\dot{Pz}/Pz) + w_4 (\dot{S}/S) \ ;$$

$$w_1 < 0, \ 0 < w_2 \leqslant 1, \ w_3 > 0, \ w_4 > 0$$

According to this equation, a lower unemployment rate leads to faster money wage increases. Since, firstly, a falling unemployment rate is generally associated with net hiring of workers, which in turn, leads firms to offer better wages than they otherwise would in order to attract the additional workers desired. It should be noted that this general case need not necessarily hold. For, as Spencer (1973)[136] points out, a falling unemployment rate could be associated also with a net firing of workers if the labor force were declining rapidly enough. On the other hand, a rising unemployment rate could be associated with a net hiring of workers if the labor force were growing rapidly enough. Secondly, a falling unemployment rate could generate expectations of a tighter labor market in the future, forcing employers to hire necessary workers and offer more to labor than they would in the present in order to avoid hiring in the future, when wages and unit labor costs are expected to be higher.

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[135] Askin and Kraft (1974), op. cit., p. 55.

[136] R. W. Spencer, "The National Plans to Curb Unemployment and inflation," *Federal Reserve Bank of St. Louis Review*, 55, No. 4, (April 1973), pp. 2-13.

The inclusion of the expected rate of inflation is used to capture the impact that inflation has on the rate of growth in money wages by affecting real wages and hence, altering the workers' bargaining position. This relationship asserts that current money wage changes depend upon the expected rate of inflation rather than the actual rate of price increases. That is, owing to the fact that the real wage increase associated with any given increase in the workers money wages varies inversely with the rate of change in the prices they pay as consumers, workers have an incentive to adjust their wage demands according to the extent of price inflation that they expect. Therefore, the sign of 'w_2' (the coefficient of expected rate of inflation) is expected to be positive but less than or equal to one.

The inclusion of the rate of change of import prices ($\dot{Pz}/Pz$) in the wage equation requires no explanation since the underlying assumption is straightforward. That is, in an open economy for which our model is built, money wages not only respond to domestic price changes but also to the changes in the prices of imported goods as well.

The inclusion of 'S' -- that is, the indicator of demand-shift variable -- is to capture the role that any change in the composition of aggregate demand may have in the change in the index of money wages. According to the demand shift hypothesis, shifts in the composition of demand, as distinct from generalized excess demand, will generate an upward movement in the money wages and the price level.[137]

In a less developed economy like that of Iran, growth is usually accompanied by rapid urbanization and industrialization. These alter not only the output-mix but also change, indirectly, tastes and the distribution of income which in turn contribute to demand shifts. That is, given a high degree of labor mobility, these growth induced changes in the demand-mix would involve no special problem. But, in Iran as well as other less developed countries, this high degree of labor mobility does not exist for various reasons such as lack of education and training as well as strong social barriers against entry into certain occupations.[138] Thus, shortages of labor will develop in the expanding sectors and labor surpluses appear in the contracting sectors of the economy. Labor shortages cause money wages to rise in the expanding sectors, while trade unions prevent money wages from falling in the contracting sectors, or the government may intervene to prevent such a downfall by introducing minimum wages. Therefore, a change in the composition of aggregate demand may lead to an increase in the money wage earnings, even if there is no increase in the level of aggregate demand, that is no change in unemployment rate 'U'.

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[137] C. Schultz, "Recent Inflation in the United States," in *Reading in Money, National Income and Stabilization policy*, by W. L. Smith and R. L. Teigen, eds., (Homewood: Irwin, 1970), revised edition, pp. 163-69; H. G. Johnson *Essays in Monetary Economics*, (Cambridge: Harvard University Press, 1967), pp. 283-84; and H. J. Bruton, *Inflation in A Growing Economy*, (Bombay: University of Bombay, 1961), Chapter 5.

[138] For a review of immobility of labor in less developed countries see: P. Streeten, *The Frontiers of Development Studies*, (London: Macmillan, 1972), Chapter 5.

It has been argued that -- Johnson (1967)[139] and Bruton (1961)[140] -- the demand-shift hypothesis has greater applicability in the less developed countries and it has been called upon in order to justify higher optimal inflation rates in these countries. Schultz (1970)[141] has applied the demand-shift hypothesis to the United States while, Bowen and Masters (1964)[142] have found a relationship between the degree of demand-shift and inflation also for the United States. Argy (1970)[143] has regressed price level on an index of demand-shift and has obtained a poor result in his cross-section study of 22 less developed countries.

The indicator of demand-shift (S) in this study could be obtained by looking at the changes in the weights of ten sectors of Iranian economy between the years 1959 and 1977. That is:

$$S(t) = [\sum_{i=1}^{10} \bar{w}_i (w_i(t) - \bar{w}_i)^2]^{1/2}; \ t=1959, \ldots , 1977$$

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[139] Johnson (1967), op. cit.
[140] Bruton (1961), op. cit.
[141] Schultz (1970), op. cit.
[142] W. Bowen and S. Masters, "Shifts in the Composition of Demand and the Inflation Problem," *American Economic Review*, (December 1964), pp. 975-84.
[143] V. Argy, "Structural Inflation in Developing Countries," *Oxford Economic Papers*, 22, (1970), pp. 75-83.

where:

$w_i(t)$ = Weight of the ith sector in the year 't',

$\bar{w}_i$ = Average weight of the ith sector over the period.

and the sectors of economy are: agriculture; oil; manufacturing and mining; water and electricity; construction; transportation and communication; domestic trade; banking, insurance and brokerage; public services; and others including ownership occupied dwelling and private services.

Equation 5:

$$(\dot{P}/P) = b_1(\dot{F}/F) + (\dot{P}i/Pi) \;;\; 0<b_1<1$$

This equation defines the rate of inflation as a weighted sum of the rate of change of the relative prices in agriculture (weight=b_1) and the rate of change of prices in the industrial sector (weight=1).

To derive this relationship, assume that the level of the index used to measure inflation is a weighted average of the level of the index of prices in the agricultural sector and the level of the index of prices in the industrial sector. Then we can write:

$$P = b_1 Pa + b_2 Pi \;;\; b_1+b_2=1 \qquad (I)$$

From equation I we can get:[144]

$$\dot{P}/P = b_1\dot{P}a/Pa + b_2\dot{P}i/Pi \qquad \text{(II)}$$

Recalling our definition of relative prices in agriculture, F=Pa/Pi, we can write:

$$\dot{F}/F = \dot{P}a/Pa - \dot{P}i/Pi \qquad \text{(III)}$$

Substitute for '$\dot{P}a/Pa$' from III into II:

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[144] To derive equation II below:

$$\dot{P}/P = [P - P(-1)] / [P(-1)]$$

$$\dot{P}/P = [P / P(-1)] - 1$$

or:

$$\dot{P}/P = [(b_1Pa+b_2Pi) / (b_1Pa(-1)+b_2Pi(-1))] - 1 \qquad \text{(i)}$$

Also:

$$\dot{P}a/Pa = [Pa - Pa(-1)] / [Pa(-1)] \qquad \text{(ii)}$$

$$\dot{P}i/Pi = [Pi - Pi(-1)] / [Pi(-1)] \qquad \text{(iii)}$$

Substitute for 'Pa' and 'Pi' from (ii) and (iii) into (i) we get:

$$\dot{P}/P = [b_1(\dot{P}a/Pa)Pa(-1)+b_2(\dot{P}i/Pi)Pi(-1)] / [b_1Pa(-1)+b_2Pi(-1)] \qquad \text{(iv)}$$

In equation (iv) both 'Pa(-1)' and 'Pi(-1)' are the level of the index of prices in agricultural and industrial sectors in the previous period respectively. Assuming that the indices are shifting-base indices with the previous period as base of unity, we can write:

$$Pa(-1) = Pi(-1) = 1$$

and (iv) will be reduced to:

$$\dot{P}/P = [b_1(\dot{P}a/Pa)+b_2(\dot{P}i/Pi)]/[b_1+b_2] \qquad \text{(v)}$$

Using the restriction '$b_1+b_2=1$', (v) will be:

$$\dot{P}/P = b_1\dot{P}a/Pa + b_2\dot{P}i/Pi$$

which is equation II below. Maynard and Ryckeghem (1976) have used the same equation, that is equation II, without stating its derivation. See G. Maynard and W. van Ryckeghem, *A World of Inflation*, (London: B. T. Batsford Ltd., 1976), p. 163.

$$\dot{P}/P = b_1\dot{F}/F + (b_1+b_2)\dot{P}i/Pi \qquad \text{(IV)}$$

or:

$$\dot{P}/P = b_1\dot{F}/F + \dot{P}i/Pi \qquad \text{(V)}$$

which is equation 5 in our model.[145]

Equation 6:

$$\text{Log}(Y) = -a_0/a_1 + 1/a_1\text{Log}(M) - 1/a_1\text{Log}(P) - a_2/a_1\pi\ ;$$
$$a_1>0,\ a_2<0$$

This relationship is basically derived from a demand function for real balances using the quantity theory of money.

In a less developed country, monetary assets play important roles. They are used for transaction purposes as well as constituting the major form in which savings are held. In Iran, there does not exist a broad range of financial assets as an alternate to money and as a result the substitution between money and goods, or real assets, becomes more important. It is therefore important for the authorities to create enough additional money to meet the increased demand for such assets in each period. If the

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[145] Note that equation II could be reached without the assumption of shifting-base indices but in a more complicated manner. That is, VIII would be formulated as:

$$\dot{P}/P = [b_1Pa(-1)/(b_1Pa(-1)+b_2Pi(-1))]\dot{P}a/Pa +$$
$$[b_2Pi(-1)/(b_1Pa(-1)+b_2Pi(-1))]\dot{P}i/Pi$$

where the sum of square brackets is unity.

creation is too rapid, the monetary expansion would lead to higher rates of inflation while an inadequate expansion would dampen the demand for goods and services.

In the less developed countries, it is widely accepted that the interest rate is an unacceptable measure of the opportunity cost of holding money. For the absence of a well-developed and organized capital market means that the interest rate does not act as an equilibrating variable for savers and investors and the possibilities of substitution between money and other financial assets are limited. Added to this absence of adequate financial assets is the problem created by the government authorities -- as Park (1973),[146] Galbis (1979),[147] Aghevli-et.al. (1979),[148] and Crockett and Evans (1980)[149] have pointed out -- who maintain controls or ceilings over the rates of interest on the financial assets that are available. Since changes are not made frequently, the interest rate series show very little variations over time and could not reflect the market conditions. Thus, it would be difficult to test, empirically, any relationship between money and interest rates.[150] Money could then be regarded as the only financial asset and the government could be assumed to borrow only from the central bank. Therefore, one can argue, as did Polak and Argy (1971),[151] that the quantity theory which includes income as the only variable in explaining the demand for money is more realistic or more applicable to a less developed country like Iran. However, in a study by Park (1970)[152] it is shown that the income velocity of money is more subject to short term variation in less developed countries than in advanced ones. As a result, the quantity theory becomes inadequate in the face of an unstable velocity of money.

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[146] Y. C. Park, "The role of Money in Stabilization Policy in Developing Countries," I. M. F., *Staff Papers*, 20, (1973), pp. 379-430.

[147] V. Galbis, "Infaltion and Interest Rate Policies in Latin America: 1967-1976," I. M. F., *Staff Papers*, 26, (1979), pp. 334-66.

[148] B. B. Aghevli, M. S. Khan, P. R. Narvekar and B. K. Short, "Monetary Policy in Selected Asian Countries," I. M. F., *Staff Papers*, 26, (1979), pp. 775-824.

[149] A. D. Crockett and O. J. Evans, "Demand for Money in Middle Eastern Countries," I. M. F., *Staff Papers*, 27, (1980), p. 549.

A number of studies, Cagan (1956),[153] Deaver (1970),[154] Diz (1970),[155] Campbell (1970),[156] Hu (1971),[157] and more recently studies by Khan (1975),[158] Jacobs (1977),[159] Khan (1977)[160] and Wong (1977)[161] have focused on the opportunity cost of holding money in the less developed countries by suggesting that the relevant opportunity cost is the rate of return on physical assets or goods, namely the expected rate of inflation, and the rate of return on financial assets can be ignored. That is, in inflation or in hyperinflation the changes in real cash balances are the result of variation in the expected rate of change in prices. In most of these studies the expected rate of inflation has been found to be a powerful explanatory variable in the demand for money function. The justification for such a choice is that in less developed countries the choices of assets are restricted to either holding money or real goods such as land, houses, or consumer durables. Under such circumstances the expected rate of inflation could be regarded as an appropriate proxy for the opportunity cost of holding money.

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[150] For a detailed discussion of this problem and an alternative view on the demand for money in less developed countries, see R. I. McKinnon, *Money and Capital in Economic Development*, (Washington, D.C.: The Brookings Institution, 1973).

[151] J. J. Polak and V. Argy, "Credit Policy and the balance of Payments," I. M. F., *Staff Papers*, 18, (1971), pp. 1-24.

[152] Y. C. Park, "The Variability of Velocity: An International Comparison," I. M. F., *Staff Papers*, 17, (1970), pp. 620-37.

[153] P. Cagan, "The Monetary Dynamics of Hyperinflation," in *Studies in the Quantity Theory of Money*, by M. Friedman, ed., (Chicago: University of Chicago Press, 1956).

[154] J. V. Deaver, "The Chilean Inflation and the Demand for Money," in *Varieties of Monetary Experience*, by D. Meiselman, (Chicago: University of Chicago Press, 1970), pp.9-67.

[155] A. C. Diz, "Money and Prices in Argentina," in Meiselman (1970), ibid., pp. 69-161.

[156] C.D. Campbell, "The Velocity of Money and the Rate of Inflation: Recent experiences in South Korea and Brazil," in Meiselman (1970), ibid., pp. 339-85.

[157] T. W. Hu, "Hyperinflation and the Dynamics of the demand for Money in China," *Journal of Political Economy*, (January-February 1971), pp. 186-95.

Therefore, the demand for real money balances can be specified as a function of real income as well as the expected rate of inflation. In log-linear terms, the function can be written as:

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[158] M. S. Khan, "The Monetary Dynamics of Hyperinflation: A Note," *Journal of Monetary Economics*, 1, (1975), pp. 355-62.

[159] R. L. Jacobs, "A Comment on Khan's Estimate of Hyperinflation," *Journal of Monetary Economics*, 3, (1977), pp.113-18.

[160] M. S. Khan, "The Monetary Dynamics of Hyperinflation: A reply," *Journal of Monetary Economics*, 3, (1977), pp. 119-21.

[161] C. H. Wong, "Demand for Money in Developing Countries," *Journal of Monetary Economics*, 3, (1977), pp.59-86.

$$\text{Log}(M/P) = a_0 + a_1\text{Log}(Y) + a_2\pi \; ; \qquad \text{(I)}$$

$$a_1>0,\ a_2<0$$

where:

M = Stock of nominal money balances,

P = Price level,

Y = Level of real income, and

π = Expected rate of inflation.

The income elasticity, 'a_1', is expected to be positive. The inflation coefficient, 'a_2', is expected to be negative to reflect the opportunity cost of holding money balances relative to real goods. That is, an increase in the expected rate of inflation increases the cost of holding money and as a result raises the velocity of money.

The function has been specified in log-linear form since there is empirical evidence -- Zarembka (1968)[162] and Morgan (1979)[163] -- that this form is a preferred functional form. In addition by writing the equation in logarithmic form, elasticities can be obtained directly. It should be noted that this equation is in semi-logarithmic form with respect to the expected rate of inflation.[164] Frenkel (1977)[165] has tried both the semi-logarithmic and logarithmic forms of the demand for money equations for the

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[162] P. Zarembka, "Functional Form in the Demand for Money," *Journal of the American Statistical Association*, 63, (June 1968), pp. 502-11.

[163] D. R. Morgan, "Fiscal Policy in Oil Exporting Countries," I. M. F., *Staff Papers*, 26, (March 1979), p. 83.

[164] See Cagan (1956), op. cit.

[165] J. A. Frenkel, "The Forward Exchange Rate, Expectations, and the Demand for Money: The German Hyperinflation," *American Economic Review*, 67, (September 1977), pp. 653-70.

German hyperinflation and concludes that there is no clear preference for either one of them.

Expanding the logarithms and following Laidler (1975)[166] in considering the direction of causation in our model concerning real income (Y) as the dependent variable we can write:

$$\text{Log}(Y) = -a_0/a_1 + 1/a_1\text{Log}(M) - 1/a_1\text{Log}(P) - a_2/a_1\pi$$

$$a_1>0,\ a_2<0 \qquad \text{(II)}$$

which is equation 6 in our model.

As was mentioned earlier, the public measures the opportunity cost of holding money relative to goods by the expected rate of inflation. The expected rate of inflation is assumed to be generated by the adaptive expectations or error-learning mechanism, that is:

$$\Delta\pi = \theta[\Delta\,\text{Log}(P) - \pi_{-1}]\ ;\ 0< \theta \leq 1 \qquad \text{(III)}$$

where 'θ' denotes the coefficient of adjustment and 'Δ Log(P)' refers to the current rate of inflation.

At this point it should be noted that total liquidity in Iran is composed of currency, demand deposits, and quasi-money (that is time and saving deposits). Until 1966, narrow money, defined as currency plus demand deposits, constituted the major portion of total liquidity. However, since 1966 the volume of quasi-money has grown substantially. With regard to the appropriate definition of money there is no unanimity in the literature. Traditionally, money has been defined in its narrow sense but a number of economists have used the broad definition of money in their empirical works. Metzler (1963)[167] has argued that whichever form of money that proves to behave in a more stable fashion in relation to variables in the real sector could be considered as the appropriate definition. The choice of the appropriate definition of money for our study would be based on this criterion.

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[166] D. Laidler, "The Influence of Money on Real Income and Inflation: A Simple Model With Some Empirical Tests for the United States, 1953-72," in his *Essays on Money and Inflation*, (Manchester: Manchester University Press, 1975), pp.134-65.

Equation 8:

$$\text{Log}(M) = m_0 + m_1\text{Log}(D+e_1) + m_2\text{Log}(BP+e_2) + \text{Log}(M)_{-1}$$

$$m_1>0,\ m_2>0;\ e_1>0,\ e_2>0$$

This relationship defines the stock of money as a function of government deficit (expenditures-revenues) and the balance of payments surplus. Recently a number of studies: Dutton (1971),[168] Otani and Park (1976),[169] Khan

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[167] A.H. Metzler, "The Demand for Money: The Evidence from the Time Series," *Journal of Political Economy*, (June 1963).

[168] D. S. Dutton, "A Model of Self Generating Inflation: The Argentine Case," *Journal of Money, Credit and Banking*, (May 1971), pp. 245-62.

[169] I. Otani and Y. C. Park, "A Monetary Model of the Korean Economy," I. M. F., *Staff Papers*, 23, (1976), pp. 164-199.

(1976),[170] de Silva (1977),[171] Aghevli (1977)[172] Aghevli and Khan (1977)[173] and Scarfe (1977)[174] have argued for an endogenous money supply in an open economy whose expansion has been caused and perpetuated by inflation.

The rationale behind this equation is in line with the above studies in that under a fractional reserve system, the change in the supply of money can be specified as a multiple of the change in the stock of reserve money. Changes in reserve money come from the government budget deficit, changes in the central bank's credit to the non-government sector and the balance of payments surplus. On these grounds, the reaction function of monetary authorities may be written as:

$$\Delta M = f(D , BP); \; f_1>0, \; f_2>0$$

where:

M = Nominal stock of money,

D = Government budgetary deficit,

BP = Over-all balance of payments surplus,

and 'f_1' is the proportion of the government budget deficit which is financed by new money creation and 'f_2' is the extent to which the balance of payments surplus becomes monetized.

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[170] M. S. Khan, "A Monetary Model of Balance of Payments: The Case of Venezuela," *Journal of Monetary Economics*, 2, (1976), pp. 311-32.

[171] K. E. A. de Silva, "Money Supply, Inflation and the Balance of Payments in Sri Lanka," *Journal of Development Studies*, 13, (1977), pp.22-36.

[172] B. B. Aghevli, "Money, Prices and the Balance of Payments: Indonesia, 1968-73," *Journal of Development Studies*, 13, (1977), pp.37-57.

[173] B. B. Aghevli and M. S. Khan, "Inflationary Finance and the Dynamics of Inflation: Indonesia," *American Economic Review*, 67, (1977), pp. 390-403.

[174] Scarfe (1977), op. cit., p.52.

To specify the exact functional form of this reaction function of monetary authorities for the estimation purposes, a number of linear and non-linear forms were tried and, as we will see in Chapter VI, the most suitable and convenient form was the logarithmic version of the relationship. That is:

$$\Delta \mathrm{Log}(M) = m_0 + m_1 \mathrm{Log}(D+e_1) + m_2 \mathrm{Log}(BP+e_2)$$

where 'm_0' is a shift parameter, '$m_1>0$' is the proportion of the government budget deficit which is financed by new money creation and '$m_2>0$' is the extent to which the balance of payments surplus becomes monetized. 'e_1' and 'e_2' are sufficiently large positive constants to make the rial values of both the government budget and balance of payments deficits positive.

Rewriting the equation in the following form:

$$\mathrm{Log}(M) = m_0 + m_1 \mathrm{Log}(D+e_1) + m_2 \mathrm{Log}(BP+e_2) + \mathrm{Log}(M)_{-1}$$

$$m_1>0,\ m_2>0;\ e_1>0,\ e_2>0$$

constitutes equation 8 of our model.

Equation 9:

$$D = G - R$$

This relationship defines the domestic government budget deficit as the difference between total domestic government expenditures and total domestic government revenues. It should be noted that it is the domestic budget deficits that are responsible for any effect the government budget has on the monetary sector. Since a large proportion of the total government revenues in Iran has been from foreign sources (oil revenues as well as taxes on oil companies, foreign loans and foreign aids), the effect of these factors would be transmitted to money supply through changes in reserve money via the balance of payments surplus.

Equation 10:

$$\mathrm{Log}(G/P) = \delta g_0 + \delta g_1 \mathrm{Log}(Y) + (1-\delta)\mathrm{Log}(G/P)_{-1} \ ; \quad g_1 > 0, \ 0 < \delta < 1$$

This relationship relates the real government expenditures to the rate of inflation as well as real income. That is, the higher the price level the lower the real government expenditures would be. Nominal government expenditures have to increase in order to maintain and adjust the real expenditures to the desired level.

Assuming that the desired real government expenditures are related to the level of real income, we can write:

$$\mathrm{Log}(G/P)^* = g_0 + g_1 \mathrm{Log}(Y) \ ; \ g_1 > 0 \qquad \text{(I)}$$

where:

G = Nominal government expenditures,

P = Price level,

Y = Level of real income, and

* denotes the 'desired level'.

Equation I is an equilibrium one and we should allow for the possibility that real government expenditures adjust with delay to changes in income and prices. Generally, lags are introduced into the framework of the model through imposing a partial adjustment or error-learning mechanism on the model. This mechanism was popularized by Chow (1966)[175] and later was used by Mundell (1971)[176] to deal with the problem of inflation. According to this approach, the actual real government expenditures are assumed to adjust to the difference between the desired real government expenditures and the actual real government expenditures. This means that the government attempts, in the face of inflation, to keep its real expenditures constant. Thus:

$$\Delta \mathrm{Log}(G/P) = \delta[\mathrm{Log}(G/P)* - \mathrm{Log}(G/P)_{-1}]$$

$$0 < \delta < 1 \qquad \text{(II)}$$

where 'δ' is the coefficient of adjustment. and 'Δ' is the difference operator. Substituting I into II:

$$\Delta \mathrm{Log}(G/P) = \delta[g_0 + g_1\mathrm{Log}(Y) - \mathrm{Log}(G/P)_{-1}] \qquad \text{(III)}$$

Rewritting III in level form:

$$\mathrm{Log}(G/P) = \delta g_0 + \delta g_1\mathrm{Log}(Y) + (1-\delta)\mathrm{Log}(G/P)_{-1}$$

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[175] G. C. Chow, "On the Long-Run and Short-Run Demand for Money," *Journal of Political Economy*, 74, (April 1966), pp. 111-31.

[176] R. A. Mundell, "The Problem of Stopping Inflation," in his *Monetary Theory: Inflation, Interest and Growth in the World Economy*, (California: Pacific Publishers, 1971), pp. 64-73.

which is equation 10 in our model.

It should be noted that the specification of the adjustment mechanism of equation II above involves the assumption that the government authorities, in the face of inflation, attempt to keep their real expenditures constant. This assumption has been criticized in the literature and White (1978)[177] suggests that the adjustment function could be specified in terms of nominal variables, that is:

$$\Delta \mathrm{Log}(G) = \delta [\mathrm{Log}(G)^* - \mathrm{Log}(G)_{-1}] \qquad \text{(IV)}$$

Substituting I in IV:

$$\mathrm{Log}(G/P) = \delta g_0 + \delta g_1 \mathrm{Log}(Y) + (1-\delta)\mathrm{Log}(G_{-1}/P) \qquad \text{(V)}$$

Equation V is the same as equation 10, except that the lagged dependent variables on the right hand side are different. However, if the coefficient of adjustment 'δ' approaches unity, the two adjustment functions become equal and there would be no difference in specifying the adjustment mechanism either in nominal or real terms.

Equation 11:

$$\mathrm{Log}(R) = \eta r_0 + \eta r_1 \mathrm{Log}(YP) + (1-\eta)\mathrm{Log}(R)_{-1} \; ;$$

$$r_1 > 0, \quad 0 < \eta < 1$$

The level of domestic government revenues in Iran is composed of direct and mainly indirect taxes on domestic sources. In this case, the level of nominal income is the most important factor in determining the domestic revenues of the government.

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[177] W.H. White, "Improving the Demand for Money Function in Moderate Inflation," I. M. F., *Staff Papers*, 25, (September 1978), pp. 570-73.

Because of the structure of tax system and the method of tax collection in Iran and due to the lags involved in the assessment of certain taxes and country's heavy dependence on foreign trade, nominal government revenues generated by the nominal income are not adequate and they tend to adjust slowly to the rise in the level of prices.

Following the suggestion by Chelliah (1971),[178] generated or desired nominal government revenues are assumed to be dependent on the level of income, that is:

$$\mathrm{Log}(R)^* = r_0 + r_1 \mathrm{Log}(YP) \; ; \; r_1 > 0 \qquad \text{(I)}$$

where:

R = Domestic nominal government revenues,

Y = Level of real income,

P = Price level, and

* denotes the generated level of revenues.

Assuming that the nominal revenues adjust to the difference between the generated nominal revenues and actual nominal revenues, we can write:

$$\Delta \mathrm{Log}(R) = \eta \left[\mathrm{Log}(R)^* - \mathrm{Log}(R)_{-1} \right]$$
$$0 < \eta < 1 \qquad \text{(II)}$$

where 'η' is the coefficient of adjustment. Substituting I into II and re-arranging the terms:

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[178] R.J. Chelliah, "Trends in Taxation in Developing Countries," I. M. F., *Staff Papers*, 18, (July 1971), pp. 254-331.

$$Log(R) = \eta r_0 + \eta r_1 Log(YP) + (1-\eta)Log(R)_{-1}$$

which is our equation 11 in the model.

In the long-run, if the government revenues increase at the same rate as the nominal income does, one would expect the elasticity of revenues (r_1) to be equal to unity. This means that, in the long-run, the government revenues and expenditures both increase at the same rate. However, within the structure of this model, even if we start with a balanced budget, as nominal income increases we would observe a divergence between government expenditures and revenues if the government expenditures adjust faster than the government revenues, that is if '$\delta > \eta$'. Then the nominal government deficit (D) will be a function of the increase in the level of prices.

In fact there are some reasons for expecting that the government expenditures adjust faster than the government revenues in the face of inflation in a less developed country such as Iran. First, the government finds it difficult to lower its expenditures in real terms even if they fully recognize the need for it during inflationary periods. Secondly, as Tanzi (1977)(7) has pointed out, in contrast to the most developed and industrialized countries where nominal revenues often keep pace with price rises, in less developed countries they lag behind quite substantially. This is the case in Iran for: (i) the tax payments for income taxes are related to incomes that are typically not as current as they are in most of the advanced economies and, (ii) tax system in Iran is heavily dependent on indirect taxes and on foreign trade taxes.[180] It is well known that the indirect taxes are mostly regressive as compared to the direct taxes and in the case of Iran, as Looney (1973)[181] points out, the bulk of the tax revenues come from regressive indirect taxes. It should be added that the indirect taxes in Iran are often specific and even in the case of ad-valorem taxes, the adjustment of base values for some of these taxes are not frequent enough to keep up with inflation. For example, in Iran, the prices of some basic products such as fuel, sugar, flour, tea and tobacco which are the main sources of taxation are controlled by the government. In addition, long delays occur in the periodic assessment or reassessment of values needed, for example, for property taxes.

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(7) V. Tanzi, "Inflation Lags in Collection and the Real Value of Tax Revenue," I. M. F., *Staff Papers*, 24, (March 1977), PP.154-67.

Equation 12:

$$BP = X.Px + Xoil.Poil - Z.Pz + K$$

where:

BP = Balance of Payments surplus,

X = Volume of non-oil exports,

Xoil = Volume of oil exports,

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[180] R. Looney, *The Economic Development of Iran*, (New York: Praeger, 1973), Chapter 4.
[181] Ibid. pp. 71-77.

Z = Volume of imports,

K = Net capital flows (balance of payments on capital account),

Px = Prices of non-oil exports in domestic currency,

Poil = Prices of oil exports in domestic currency,

Pz = Prices of imports in domestic currency (Pz=Q.E, where 'Q' is the price of imports in terms of foreign currency and 'E' is the exchange rate defined as the price of foreign currency in terms of domestic currency, which is fixed).

The structure of the Iranian economy can be divided into two sectors: the oil sector and the rest of the economy. The economic causation tend to run from the oil sector to the rest of the economy via the government authorities and this allows us to treat the oil sector essentially as exogenous.[182] The volume of exports is dependent on foreign factors alone and is treated exogenously. In a world of perfect capital mobility, net foreign capital flows can be determined endogenously. However, in the context of a less developed economy free capital mobility is far from reality since the government imposes a variety of controls over capital flows. In order to achieve a sustained capital formation in the process of economic growth, the government of Iran has imposed control measures over capital inflows and capital outflows.[183] Therefore, we consider net capital flows (K) as an exogenous variable in our model.

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[182] This is in line with Khan's study of Venezuela. See Khan (1976), op. cit.

Since Iran is a small country relative to the rest of the world, we can assume that the prices of imports (Pz) and its prices of non-oil exports (Px) are determined in the world market, and hence treat them exogenously.

It should be added that, if the exchange rate was flexible, then it would adjust such that the balance of payments is in equilibrium, that is 'BP=0'. Therefore, under a flexible exchange rate regime, there would be no feed-back from the balance of payments to the domestic money supply.

Equation 13:

$$\mathrm{Log}(Z) = \mu z_0 + \mu z_1 \mathrm{Log}(Y) + \mu z_2 \mathrm{Log}(Pz/P) + (1-\mu)\mathrm{Log}(Z)_{-1} \quad ;$$

$$z_1 > 0,\ z_2 < 0,\ 0 < \mu < 1$$

This equation specifies that the demand for real imports is a function of total demand for goods and services (real income) and the price of imports in domestic currency relative to domestic prices (Pz/P).

The desired demand for imports is specified as follows:

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[183] R. Looney, *A Development Strategy for Iran Through the 1980's*, (New York: Praeger, 1977), Chapter 7.

$$\mathrm{Log}(Z)^* = z_0 + z_1\mathrm{Log}(Y) + z_2\mathrm{Log}(Pz/P)$$

$$z_1>0,\ z_2<0 \qquad \text{(I)}$$

where:

Z = Volume of imports,

Y = Level of real income,

P = Level of prices,

Pz = Prices of imports in domestic currency, and

* denotes the desired level.

It is assumed that, although the world supply schedule for a small open economy like Iran is infinitely elastic with respect to prices that are determined in the world market, Iran is not able to import all it wants within a given period. This assumption could be justified on the grounds that importers must go through certain administrative procedures to obtain licences for imports and in addition, the international transportation of goods take time. Therefore, we can hypothesise that only part of the desired level of imports will arrive in the country within a given period of time.

Assuming that the actual volume of imports adjust to the gap between the desired level of imports and the actual level of imports, we can write:

$$\Delta\,\mathrm{Log}(Z) = \mu\,[\mathrm{Log}(Z)^* - \mathrm{Log}(Z)_{-1}]$$

$$0<\mu<1 \qquad \text{(II)}$$

where 'μ' is the coefficient of adjustment. Substituting I into II and re-arranging the terms:

$$\mathrm{Log}(Z) = \mu z_0 + \mu z_1 \mathrm{Log}(Y) + \mu z_2 \mathrm{Log}(Pz/P) +$$
$$(1-\mu)\mathrm{Log}(Z)_{-1}$$

which is equation 13 of our model.

Equation 14:

$$U = u_0 + u_1[\ \mathrm{Log}(Y) - \mathrm{Log}(\overline{Y})\ ];\ u_1>0$$

where:

U = Unemployment rate,

Y = Level of real income,

$\overline{Y}$ = Full-employment level of real income.

This relationship specifies that the excess product demand as measured by the deviation of real income from its full-employment level is related to the unemployment rate by a linear relationship. Okun (1970)[114] has given some empirical support to this relationship. He argues that there exist a reasonably stable relationship between output and unemployment rate over the business cycle assuming that '$\overline{Y}$' is exogenous. His empirical analysis reveals that a one percent rise in the rate of unemployment is associated with 2.8 percent decrease in real output.[115] This short-run relationship is known as Okun's Law.

It can be demonstrated that all equations in the above model are identified. That is, all the behavioral equations satisfy the order condition for identifiability.[186] Consequently, the two-stage least squares and non-linear two-stage least squares econometric techniques can be employed to obtain the estimates of the parameters of the model, which are done in the next chapter.

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[114] A. M. Okun, *The political Economy of Prosperity*, (Washington D. C.: The Brookings Institution, 1970).
[115] Ibid., pp. 135-36.

In summary, insofar as the causes of inflation are concerned the model above is an attempt to develop a broadly based analysis of inflation specific to Iran as a less developed country. It encompasses a range of potential bottlenecks in the economy as well as explicitly accounting for the propagation mechanism in the economy in general and the expansion in money supply in particular which is necessary for the manifestation of spiralling price rises.

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[186] See F. M. Fisher, *The Identification Problem*, (New York: McGraw-Hill, 1966); and D.L. Edgerton, "Some Properties of Two Stage Least Squares as Applied to Non-Linear Models," *International Economic Review*, 13, (February 1973), pp. 26-32.

VI. ECONOMETRIC ANALYSIS OF THE MODEL OF INFLATION FOR IRAN

In this chapter, econometric procedures and the results of estimating the model outlined in the previous chapter are presented and discussed.

The chapter is divided into five sections. The first section is devoted to a discussion of the data used in various econometric analyses of the model. The second section is devoted to a discussion of econometric procedures and problems. The third section analyses the adequacy of food production in Iran during the period covered by this study (1959-1977). the fourth section deals with the simultaneous equation estimation of the model of inflation, while the last section presents a summary of the results.

A. The Data

The data used in this study are all defined in terms of the domestic currency (Iranian rial) and were obtained from various sources (see the Bibliography).

The data cover the period 1959-1977 annually. This selection is dictated by the availability of data. The absolute values of variables are all measured in millions of Iranian rials, and the rates are all recorded as percentages.

In the model, Gross Domestic Product (GDP) is used as a proxy for income (Y). Full-employment level of income ($\overline{Y}$) appears as a trend variable in the model. In order to stay as close to the theoretical model as possible the trend value of income over the sample period (1959-1977) was used to measure it.[187] We should point out that full-employment income could have been approximated by a weighted moving average of real income, or as some researchers have employed, by simple moving averages of from two to four years.[188] But the small number of observations (a total of 19) dictated our choice. An index of compensation of employees out of GDP is used as a proxy for the wage variable (W). The real output per-person in industrial sector (I) is proxied by the ratio of real value added in the industrial sector of the Iranian economy (sum of real value added in mining and manufacturing, water and electricity, and construction) to total employment in that sector. The index of capacity utilization (Cu) is derived -- employing the Federal Reserve Board definition[189] -- by the ratio of the index of production (real income) to an index of capacity (full-employment real income). The measure of unemployment rate 'U' used is as follows:[100]

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[187] '$\overline{Y}$' was chosen as the fitted value of 'Y' by regressing it on trend term and trend term squares.

[188] K. L. Gupta, "On Some Determinants of Rural and Urban Household Saving Behaviour," *The Economic Record*, (December 1970), pp. 580-1. See also: D. W. Snyder, "Econometric Studies of House-hold Saving Behavior in Developing Countries: A Survey," *Journal of Development Studies*, 10, (January 1974), pp. 141-44; R. F. Mikesell and J. E. Zinser, "The Nature of the Saving Function in Developing Countries: A Survey of the Theoretical and Empirical Literature," *Journal of Economic Literature*, 11, (March 1973), p. 9; and D. E. W. Laidler, *Essays on Money and Inflation*, (Manchester: Manchester University Press, 1975), p. 140.

[189] *Federal Reserve Bulletin and Statistical Release*, E.5.

U = (Active Population - Employment) / (Active Population)

The available data on active population -- defined as the population between ages 14 and 64 -- and employment levels are available only for the period 1962-1975.[101] The figures for the remaining periods were generated by regressing the respective variables on a trend term and a trend term squares. Concerning the measure of price inflation (as was discussed earlier in Chapter II), although the GDP deflator is the most general measure of prices in an economy for a number of reasons its choice may be inappropriate for the Iranian economy. First, the aggregate GDP deflator -- calculated for Iran using GDP and GDP at constant 1975 prices supplied by IMF in IFS yearbook 1980 -- reflects changes in the price of oil exports. Second, the GDP deflator captures changes in the prices of domestic output only. Since we are dealing with inflation as a whole in the context of the Iranian economy and also we are using the inflation rate as a measure of the opportunity cost of holding money compared with buying goods, the inflation measure should also include changes in the prices of imported goods and services. Therefore, the consumer price index (CPI) may be a theoretically preferable choice to the

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[100] See: F. Modigliani and E. Tarantelli, "A Generalization of the Phillips Curve for A Developing Country," *Review of Economic Studies*, 40, (1973), pp. 209-10.

[101] Echo of Iran, *Iran Almanac and Book of Facts*, issues 1969-1978.

GDP deflator for our analysis. However, as will be discussed later, the CPI itself is not a perfect measure either. The main reason is that the consumption basket used reflects the purchasing patterns of only a particular income segment and employs data relating only to the capital city.

As evident from equation 7 of our model, it has been assumed that the public adjusts its expectations of inflation according to the following relationship:

$$\Delta\pi = \theta[\Delta \mathrm{Log}(P) - \pi_{-1}] \; ; \; 0 < \theta \leq 1$$

or:

$$\pi = [\theta / (1-(1-\theta)L)] \Delta \mathrm{Log}(P)$$

where 'L' is the lag operator. As noted earlier, this formulation implies that the public adjusts its expectations of inflation according to the difference between the actual inflation rate and the expectations entertained in the previous period. As estimates showed, the adjustment coefficient was very close to unity for Iran. In the econometric analysis of the model, the expected rate of inflation was generated for a range of values of 'θ'. The appropriate value of 'θ' was then chosen on the basis of the relationship which yielded the highest coefficient of determination.[192] The value of 'θ' for Iran was between 0.90 and unity in the estimation of both wage and demand for money equations, implying that almost all of the adjustment of the public's price expectations is done within one year. This high value of 'θ' could be partially due to the fact that Iran has undergone a period of rapid inflation since 1970 and that the public was over-compensating in its expectations of inflation based on its previous experience. Thus, the actual rate of inflation was used as a proxy for the expected rate of inflation since the public seems to adjust its expectations as to the rate of inflation very rapidly to the actual rate. This choice may also be a legitimate approximation in view of the fact that annual data are being employed in the econometric study of our model.

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[192] This method was first utilized by : P. Cagan, "The Monetary Dynamics of Hyperinflation," in *Studies in the Quantity Theory of Money*, by M. Friedman, ed., (Chicago: University of Chicago Press, 1956).

Finally, it should be mentioned that the choices of proxies are all dictated by the limitations of the data for Iran.

Some Short-comings of the Data

As Taylor (1979)[113] points out, it is hard to obtain accurate data in a less developed country and

> ... one's style of data handling and parameter specification must be attuned to the kinds of numbers that can be obtained readily from the overworked, undercomputerized statistical services of developing countries.[114]

As is the case with Iran, the reliability of data available could not always be objectively estimated. In some cases cross-checks have been made with other independent information.

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[113] L. Taylor, *Macro Models for Developing Countries*, (New York: McGraw Hill, 1979).
[114] Ibid., p.3.

Although no definite argument could be made concerning the reliability of Iranian data used in this study, we feel more uncomfortable with the data on GDP and on prices. One of the main reasons is that a significant part of GDP in Iran comes from the subsistence sector whose output is simply estimated by the use of the United Nations guidelines in order to achieve international comparability. In addition, there are village activities which lead to rural production that may not be taken into account in the estimation. For example, many construction activities in rural Iran -- such as schools as well as other buildings, country roads, etc. -- are built and maintained on a communal basis by the rural people. These additions to capital are rarely recorded in money terms. Moreover, villages in Iran abound with many unrecorded monetary and barter transactions that the U. N. estimation guidelines may also ignore. Therefore, it is likely that the data on national accounts for Iran are underestimates.

Iranian data does provide different indices of price level. But, these indices are based on surveys of families and industries in major cities if not Tehran, the capital city, alone. Consumer price index, in addition, contains several items which are heavily subsidized or are subject to price controls. Moreover, there exist no indication that these indices have undergone major revisions since they were first set up in the early 1960's.

Finally, it should be added that these data short-comings seem to be pervasive in that most studies on less developed countries are faced with similar problems.

B. Estimation Procedure and Problems Encountered

In the econometric analysis presented below the Time Series Processor (TSP) computer package was employed. In the single equation estimation, Part C, the Ordinary Least Squares (OLS) estimation technique was used, while in the simultaneous estimation of the model, Part D, the Two Stage Least Squares (2SLS) as well as 2SLS technique for non-linear equations (LSQ) were employed. Finally, in the simulation analysis of the model, discussed in the next chapter, the APL computer language was employed.

One main econometric problem, autocorrelation, was encountered. Autocorrelation, that is the serial correlation of data, was prevalent in some of the regressions run. The Durbin-Watson statistic was used to test for the presence of the problem. Wherever it occured, it was circumvented by the use of the Two Stage Least Squares Cochrane-Orcutt (TSCORC) iterative procedure, incorporated in the TSP computer package. The Hildreth-Lu scanning procedure for circumventing autocorrelation, also incorporated in the TSP computer package, was also used. However, there was no difference in the results obtained by using this procedure and those obtained by using the Cochrane-Orcutt procedure.

C. Analysis of Adequacy of Agricultural Production

The analysis of adequacy of food production centers on the derived equation for the 'required' rate of growth of production of food at and for stable prices (see Chapter V), that is:

$$A^* = (\dot{N}/N) + c(\dot{y}/y) \qquad \text{(I)}$$

where:

A^* = Required rate of growth of food production for price stability,

$\dot{N}/N$ = Rate of growth of population,

$\dot{y}/y$ = Rate of growth of per-capita real income,

c = Income elasticity of demand for food.

The determination of 'A*' requires an estimate of the income elasticity of demand 'c'.

As noted in the previous chapter, a number of different estimates of income elasticity of demand for food in less developed countries can be found in the literature. Houthaker (1957)[115] argues that the typical partial income elasticity of expenditures on food in less developed countries is about 0.6. He arrives at this figure from a cross-section estimate of a large number of countries. This estimate of elasticity is based on 'total expenditures' rather than on per-capita national income, and hence tends to over-estimate the result which is needed for this study if savings or taxes grew more than proportionally with income. In addition as Meyer and Kuh (1957)[116] argue, such cross-section estimates of expenditure elasticity are generally higher than the intertemporal quantity elasticities required for this study, even when they are estimated with respect to total income. Seers (1964)[117] also estimates the income elasticity of demand for food over time assuming that the observed per-capita income elasticity of expenditures on food, not corrected for price increases, will approximate the elasticity net of price increases in open economies in which imports can correct for insufficient domestic production. He estimates the elasticity for less developed countries to be between 0.4 and 0.5. Maynard (1961)[118] reports an income elasticity of demand for food equal to 0.6 for Latin American countries without explicitly stating its statistical derivation.

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[115] H. S. Houthaker, "An International Comparison of Household Expenditures Commemorating the Centenary of Engle's Law," *Econometrica*, 25, (1957), pp. 532-51.

Gittinger (1965),[119] in a study made by planners in the Third Development Plan of Iran for the projection of demand for food over the plan period (1963-67), estimates an income elasticity of demand for food of 0.59 for the urban areas and 0.8 for the rural areas of Iran. The estimate for urban areas was based on the 1958 cost of living survey of Iran which recorded food expenditures for a sample of about 1,000 families selected from 32 cities, and on the divisions between income groups also made in the cost of living survey. However, lacking suitable survey data, there was no way to estimate rural income elasticities directly. Therefore, the planners resorted to international comparison:

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[116] J. Meyer and E. Kuh, "How Extraneous are Extraneous Estimates?," *Review of Economics and Statistics*, (November 1957), pp. 380-93. See also: G. S. Maddala, *Econometrics*, (New York: McGraw Hill, 1977), pp. 191-92.

[117] D. Seers, "Normal Growth and Distortions : Some Techniques of Structural Analysis," *Oxford Economic Papers*, 16, (1964), pp. 78-104.

[118] G. Maynard, "Inflation and Growth: Some Lessons to be drawn from Latin American Experience," *Oxford Economic Papers*, 13, (1961), pp. 184-202.

[119] J. P. Gittinger, *Planning for Agricultural Development: The Iranian Experience*, (Center for Development Planning, National Planning Association, 1965), pp. 36-37 and 42-45.

> The per-capita income of the rural population of Iran lies about midway between that of the rural population of India and that of South Italy. United Nations and FAO publications reported that income elasticity for food in rural India is about 0.87 and in South Italy about 0.74. Since rural Iran is neither as poor as rural India nor as rich as rural South Italy, it was assumed that the income elasticity for rural Iranians was 0.8 ... .[200]

Paris (1970)[201] in a survey of the point estimates of the income elasticities of demand for food in less developed countries estimates the income elasticity of food for urban areas of Iran to be 0.67 and 0.74 for that of rural areas.

On this basis, it seems that 0.7 is a realistic estimate of income elasticity of demand for food for Iran.[202]

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[200] Ibid., p. 42.

[201] Q. Paris, "An Appraisal of Income Elasticities for Total Food Consumption in Developing Countries," (Paris: Development Center of the Organization for Economic Cooperation and Development, Technical Papers, 1970) reported in *Toward A Theory of Economic Development*, by P. Zarembka, (San Francisco: Holden Day Inc., 1972), pp. 206-207.

[202] Some authors believe in an even higher, 0.8, figure for Iran. See: M. A. Katouzian, "The Agricultural Sector of the Iranian Economy: A Critical Review and a Warning," *Tahghighat-i-Eghtesadi*, (Summer and Winter 1971), p. 221 (in Persian).

As a basis for a different computation of the income elasticity of demand, the FAO estimates of per-capita food consumption -- using the physical index of calories per day -- available only for a number of periods, as well as figures on per-capita real income and relative food prices (terms of trade between food and industrial products) were used. Table VI-1 presents the available FAO estimates of per-capita food consumption in calories per day in Iran. The available data on relative price of food and the index of per-capita real income (based on 1959 prices) were averaged to provide the necessary data consistent with the available periods of daily food consumption . The regression estimate has been made of the equation:

$$Q = a_0 + a_1F + a_2y$$

where:

Q = Daily food Consumption,

F = Relative price of food,

y = Per-capita real income,

Not much confidence may be held on the precision of the result. But given the data, the OLS estimate of the demand is as follows:

$$\underset{(0.78)}{Q = 620.01} \; \underset{(-1.63)}{- 4.42F} \; \underset{(4.47)}{+ 7.00y}$$

$$R^2 = 0.8971, \quad D.W. = 2.17$$

The 't' values are in the parentheses and the mean values of the variables are as follows:

$$\bar{Q} = 2392.67$$

Table VI-1

Per-capita Food Consumption in Iran

Period	Daily Caloric Consumption
1960-62	2,050
1963-65	1,840
1966-68	2,285
1969-71	2,339
1972-74	2,649
1975-77	3,193

Source: FAO, *Production Yearbook*, Various issues.

$\overline{F} = 114.30$

$\overline{y} = 178.36$

Evaluating the income elasticity of demand at mean values of income and consumption level, the resulting estimate of 'c' is 0.52 for Iran, that is:

$c = (dQ/dy)(\overline{y}/\overline{Q})$

or:

$c = 7.00(178.36/2392.67) = 0.52$

Although neither the data used for this analysis (FAO estimates of caloric consumption are based on total presumed retail marketing, which are computed from production and trade data, do not take into account changes in stock, and guess only roughly at production of some of the crops) nor the estimate of the elasticity may be considered accurate, it is worth noting that the estimated figure for income elasticity of demand for food in Iran (0.52) lies within the range found by the earlier studies. Moreover, it should be noted that the elasticity measuring food in caloric terms might be expected to be lower than the elasticity measuring food in value terms. For the consumer who is faced with an increase in income or a decline in price will switch from cheaper to higher quality food of the same caloric content as well as increasing his consumption of calories.

The estimate of price elasticity (E), eventhough it need not be estimated for the purpose of this study, appears to be consistent with the expectation that an increase in the price of food will cause only a much smaller proportionate decrease in food consumption. Using the mean relative price and mean consumption levels, the estimated price elasticity of demand for food in Iran is -0.21, that is:

$$E = (dQ/dF)(\overline{F}/\overline{Q})$$

or:

$$E = -4.42(114.30/2392.67) = -0.21$$

Required Rate of Growth of Food Production

While it would not be advisable to select one figure to represent the elasticity of demand for food with respect to income, in what follows estimates of the required rate of growth of food production 'A*' will be made on the basis of an income elasticity range of between 0.40 and 0.70. Using these estimates of income elasticity, it is possible to determine values of 'A*' by use of equation I above.

Statistics on the rates of growth of per-capita real income and population are also utilized. The value of 'A*' determined is the rate at which production would have to increase in order to satisfy demand with no changes in the relative prices. These computed required growth rates for relative price stability can then be used in order to determine whether Iran's agricultural sector increased its food production adequately over the period of 1959-1977 or not.

Table VI-2 presents the calculated values of 'A*' on the basis of different estimates of income elasticity of demand for food (0.4, 0.5, 0.6 and 0.7). For comparison with the required rates of growth in Table VI-2, a number of indices are available from different sources, giving the levels of food and agricultural production in Iran. Two annual indices of food and agricultural production are readily available which are compiled by FAO. Table VI-3 presents these indices converted to the 1959 base year from the original data. Annual growth rates of these two indices, as well as the growth rate of real value added in agricultural sector (at 1959 prices) are shown in the first three columns of Table VI-4.

Comparison of these observed growth rates in Table VI-4 with the required rates of growth of food production for price stability given in Table VI-2 -- a procedure used by

Table VI-2

Required Rates of Growth of Food Production For Price Stability in Iran, 1959-1977. (percent)

$$A^* = \dot{N}/N + c\dot{y}/y$$

	c=0.4	c=0.5	c=0.6	c=0.7
1959-60	4.21	4.55	4.90	5.25
1960-61	2.99	3.03	3.07	3.11
1961-62	4.22	4.55	4.88	5.21
1962-63	4.32	4.68	5.03	5.39
1963-64	3.51	3.69	3.89	4.05
1964-65	6.30	7.12	7.94	8.75
1965-66	6.01	6.77	7.54	8.31
1966-67	6.19	6.99	7.80	8.60
1967-68	6.67	7.58	8.50	9.42
1968-69	6.54	7.42	8.31	9.19
1969-70	6.65	7.62	8.59	9.56
1970-71	7.25	8.09	8.92	9.76
1971-72	8.16	9.55	10.94	12.33
1972-73	6.10	7.01	7.92	8.83
1973-74	4.67	5.16	5.66	6.15
1974-75	3.80	3.82	3.84	3.85
1975-76	7.77	8.54	9.32	10.10
1976-77	-0.15	-0.46	-0.77	-1.08

Source: See the text.

Table VI-3

Indices of Food and Agricultural Production for Iran, 1959=100.

	ITFP*	ITAP**
1959	100.0	100.0
1960	94.0	96.9
1961	100.2	103.9
1962	100.2	102.3
1963	105.0	108.7
1964	100.2	105.4
1965	106.6	114.1
1966	108.9	113.3
1967	115.5	120.2
1968	119.2	125.1
1969	121.0	126.0
1970	132.1	136.8
1971	121.0	126.0
1972	133.1	140.7
1973	137.9	144.5
1974	142.7	150.7
1975	147.5	152.0
1976	158.3	163.3
1977	164.3	169.6

* Index of Total Food Production
** Index of Total Agricultural Production
Source: Calculated from data provided in:
FAO, *Production Yearbook*, 1969, 1976-77.

Table VI-4

Observed Rates of Growth of Food and Agricultural Production in Iran, 1959-1977. (percent)

	ITFP 1	ITAP 2	RVAA* 3	A** 4
1959-60	-6.00	-3.00	3.11	-2.50
1960-61	6.60	7.22	-0.10	-3.67
1961-62	0.00	-1.54	4.75	1.93
1962-63	4.79	6.25	0.75	0.32
1963-64	-4.60	-3.04	6.28	4.71
1964-65	6.39	8.25	6.35	2.41
1965-66	2.15	-7.01	2.86	1.48
1966-67	6.06	6.09	6.28	4.53
1967-68	3.20	4.70	7.10	6.88
1968-69	1.51	0.72	5.40	3.59
1969-70	9.17	8.57	6.99	4.70
1970-71	-8.40	-7.90	0.21	0.13
1971-72	9.99	11.66	8.05	8.69
1972-73	3.60	2.70	-11.90	-0.73
1973-74	3.48	4.29	-16.91	2.99
1974-75	3.36	0.86	-0.22	3.21
1975-76	7.32	7.43	9.22	8.72
1976-77	3.79	3.85	-4.83	-4.35

* Real Value Added in Agriculture (at 1959 prices)
** Trend Rate of Change of Food Production
Source: Columns 1 and 2 from Table VI-3; column 3 from Table IV-3; and for column 4 see the text.

Seers (1964)[203] and Edel (1969)[204] -- reveals that food and agricultural output in Iran failed to expand at a rate even close to the required rates of growth, 'A*', computed using even the two higher estimates of the income elasticity of demand for the entire period of 1959-1977. In fact, except for the years 1961, 1963 and 1970 all the required rates of growth have outpaced the different observed rates of growth.

The simple comparison of the observed rates of growth with the required rate is not sufficient to characterize the structural adequacy of Iranian food-producing sector. That is, if prices have increased, the expansion in production by more than 'A*' percent annually (which was observed in a few years in Iran) might in fact be because of the price increases. If this is the case, then it could not be said that the country has enjoyed a growth rate rapid enough to hold the price line. It is, therefore, necessary to consider price changes explicitly.

Price effects on food production may be incorporated explicitly by means of a regression estimate of the rate of change of supply of agricultural products. To take the effects of possible lagged price changes into account, the supply equation is written as:

$$(\dot{Q}s/Qs) = A + b_1(\dot{F}/F) + b_2(\dot{F}/F)_{-1}$$

where:

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[203] D. Seers, "Normal Growth and Distortions: Some Techniques of Structural Analysis," *Oxford Economic Papers*, 16, (1964), pp. 78-104.

[204] M. Edel, *Food Supply and Inflation in Latin America*, (New York: Praeger, 1969).

$\dot{Q}s/Qs$ = Rate of growth of agricultural supply measured by real value added in agricultural sector (at 1959 prices),

A = Trend rate of change of agricultural production expected to be positive because of the adoption of new techniques, organizational change, etc.

$\dot{F}/F$ = Rate of change of relative price of food.

The OLS estimate of the supply equation is as follows:

$$\underset{}{(\dot{Q}s/Qs)} = \underset{(3.01)}{3.82} + \underset{(3.78)}{0.41(\dot{F}/F)} + \underset{(1.34)}{0.13(\dot{F}/F)_{-1}}$$

$$R^2 = 0.6212, \ D.W. = 2.14$$

and the 't' statistics are in parentheses. Additional terms for more lagged price effects were also tried but coefficients were not significantly different from zero and were dropped.

Using the estimated supply equation, the sum of constant term (3.82) and residuals would represent the rate of growth of agricultural production which has been adjusted for any price effects on production of agricultural products. The result of this calculated trend rate 'A', are reported in column 4 of Table VI-4 above. The estimates of 'A' confirm, to whatever extent they are valid, the results arrived above. Except for 1963, the calculated required rates of growth 'A*', outpaced the estimated trend rates of growth of agricultural production net of price changes 'A'.

This result constitutes the empirical verification of our original hypothesis concerning the inadequacy of supply of agricultural product -- $A<A^*$ -- and that the deficiency in production causes an increase in the rate of change of relative prices of food.

At this stage, some points should be added concerning the price elasticity of supply in Iran. The sum of the coefficients of price changes in the supply equation represent the percentage change in output of agricultural product due to a one percent change in price and it is an estimate of the price elasticity of supply. Thus, we may consider the price elasticity of supply in Iran to be 0.54. In this case, it may possibly be incorrect to speak of an 'inelastic' supply of agricultural production, as structuralists argue, in Iran as the central aspect of the problem. But, it may seem justifiable to speak of 'inadequacy' of production trend and its failure to achieve a rate to prevent price increases in agricultural sector of the Iranian economy.

D. Estimation of the Model of Inflation

The model formulated in the previous chapter has a combination of linear and non-linear equations, and the system is simultaneous. The two-stage least squares method modified for the non-linear system can be shown -- Kelijian (1971)[205] and Amemiya (1974)[206] -- to yield consistent estimators for the parameters of the system.[207]

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[205] H. H. Kelijian, "Two Stage Least Squares and Econometric Systems Linear in Parameters But Non-linear in the Endogenous Variables," *Journal of the American Statistical Association*, 66, (June 1971), pp. 373-74.

[206] T. Amemiya, "The Non-linear Two Stage Least Squares

The results of the estimated behavioral equations of the model, using annual data for the period 1959-1977, are summarized in Table VI-5 where the 't' statistics are given in parentheses underneath the coefficients.

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[206] (cont'd)Estimators," *Journal of Econometrics*, 2, (July 1974), pp. 105-110.

[207] For identifiability conditions of a non-linear system see: D. L. Edgerton, "Some Properties of Two Stage Least Squares as Applied to Non-linear Models," *International Economic Review*, 13, (February 1972), pp. 26-32.

Table VI-5

Econometric Results of the Structural Equations of the Model

1) $$\dot{F}/F=\underset{(1.32)}{1.06}+\underset{(4.07)}{0.36}[(1-\underset{(1.21)}{0.47})(\dot{N}/N)+\underset{(1.21)}{0.47}(\dot{Y}/Y)-A]$$

$$R^2 = 0.6063,\ D.W. = 2.01$$

3) $$\dot{P}i/Pi=\underset{(5.03)}{0.36}(\dot{W}/W)-\underset{(-2.78)}{0.45}(\dot{I}/I)+\underset{(2.42)}{0.35}(\dot{P}z/Pz)-\underset{(-2.46)}{0.19}(\dot{C}u/Cu)$$

$$R^2 = 0.7579,\ D.W. = 1.69$$

4) $$\dot{W}/W=\underset{(8.80)}{20.50}-\underset{(-4.88)}{3.42}U+\underset{(2.04)}{0.30}(\dot{P}/P)+\underset{(1.79)}{0.26}(\dot{P}z/Pz)+\underset{(18.70)}{0.08}(\dot{S}/S)$$

$$R^2 = 0.9689,\ D.W. = 1.65$$

5) $$\dot{P}/P = \underset{(3.74)}{0.70}(\dot{F}/F) + \underset{(7.49)}{1.09}(\dot{P}i/Pi)$$

$$R^2 = 0.9180,\ D.W. = 1.42$$

6-a) Narrow money (M1) definition:

$$\mathrm{Log}(Y) = \underset{(26.71)}{7.14} + \underset{(17.52)}{0.79}\mathrm{Log}(M1) - \underset{(-6.68)}{0.64}\mathrm{Log}(P) + \underset{(2.30)}{0.35}(\dot{P}/P)$$

$$R^2 = 0.9856,\ D.W. = 1.43$$

6-b) Broad money (M2) definition:

$$\mathrm{Log}(Y) = \underset{(38.98)}{8.13} + \underset{(20.75)}{0.65}\mathrm{Log}(M2) - \underset{(-7.26)}{0.57}\mathrm{Log}(P) + \underset{(3.16)}{0.41}(\dot{P}/P)$$

$$R^2 = 0.9896,\ D.W. = 1.95$$

8-a) Narrow money (M1) definition:

$$\mathrm{Log}(M1)=\underset{(-3.40)}{-1.20}+\underset{(1.19)}{0.12}\mathrm{Log}(D)+\underset{(1.15)}{0.11}\mathrm{Log}(BP)+\underset{(5.06)}{1.10}\mathrm{Log}(M1)_{-1}$$

$$R^2 = 0.9912,\ D.W. = 1.51$$

8-b) Broad money (M2) definition:

$$\mathrm{Log}(M2)=\underset{(-4.65)}{-1.22}+\underset{(1.79)}{0.15}\mathrm{Log}(D)+\underset{(1.12)}{0.10}\mathrm{Log}(BP)+\underset{(7.56)}{1.09}\mathrm{Log}(M2)_{-1}$$

$$R^2 = 0.9949,\ D.W. = 1.71$$

10) $$\mathrm{Log}(G/P) = \underset{(-2.97)}{-6.27} + \underset{(3.00)}{0.95}\mathrm{Log}(Y) + \underset{(2.49)}{0.46}\mathrm{Log}(G/P)_{-1}$$

$$R^2 = 0.9849,\ D.W. = 1.61$$

11) $$\mathrm{Log}(R) = \underset{(-1.97)}{-2.95} + \underset{(1.71)}{0.30}\mathrm{Log}(YP) + \underset{(4.65)}{0.78}\mathrm{Log}(R)_{-1}$$

$$R^2 = 0.9829,\ D.W. = 1.93$$

13) $$\mathrm{Log}(Z)=\underset{(-1.30)}{-2.85}+\underset{(3.81)}{0.89}\mathrm{Log}(Y)\underset{(-2.07)}{-0.57}\mathrm{Log}(Pz/P)+\underset{(2.89)}{0.44}\mathrm{Log}(Z)_{-1}$$

$$R^2 = 0.9884,\ D.W. = 1.59$$

14) $$U = \underset{(1.79)}{0.25} + \underset{(1.67)}{0.67}[\mathrm{Log}(Y) - \mathrm{Log}(\overline{Y})]$$

$$R^2 = 0.9342,\ D.W. = 1.27$$

Rate of Change of Relative Price of Food Equation

As equation 1 of Table VI-5 shows, all the coefficient estimates have the predicted signs. The estimates are also greater than their respective standard errors. The coefficient estimates of the equation are as follows:

$f_0 = 1.06$

$f_1 = 0.36$

$c = 0.47$

The estimate of income elasticity of demand for food is 0.47 which is not significantly different from our earlier estimate of income elasticity which was 0.52, using the FAO supplied per-capita food consumption figures and per-capita real income. It also compares favourably with the estimates of income elasticity of demand for food in less developed countries reported in the literature in section 'C' above. The responsiveness of the rate of change of relative prices to the rate of growth of population is 0.20 -- $0.36(1-0.47)=0.20$ -- indicating that the relative prices of food rises less than proportionally as population grows.

The estimation result of equation 1 is also consistent with our hypothesis concerning the adequacy of growth of food production in that the rate of change of relative prices in agriculture is dependent on the difference between the required rate of growth and the estimated trend growth rate of agricultural production net of price changes. This finding compares favourably with that of Argy (1970)[208] who attempted to appraise the contribution of structural elements in a cross-section study of inflation in 22 less developed countries. In ten of his equations using two different indices of excess demand in agriculture, all had the right signs and six were statistically significant suggesting a tendency for countries with inadequate supply of food to have higher rates of inflation.

Rate of Change of Industrial Prices Equation

The estimation of equation 3 shows that the coefficients of '$\dot{W}/W$', '$\dot{I}/I$' and '$\dot{Pz}/Pz$' have the predicted signs which we expected them to have on the basis of the theoretical argument underlying the industrial price equation of our model. The equation is well determined in the sense that the estimates of the coefficients are all significant at 2.5 percent level. The theory requires that, first, the coefficients of rates of change of wages, $\dot{W}/W$, and import prices, $\dot{Pz}/Pz$, are positive numbers lying between zero and one, since they represent the proportion of labor cost and the proportion of imported material costs to aggregate variable cost in the economy as a whole respectively. Secondly, that these coefficients sum to unity. It can be seen that the coefficients of '$\dot{W}/W$' and '$\dot{Pz}/Pz$', 0.36 and 0.35 respectively, reproduce these properties to the extent that both are positive numbers lying between zero and unity. They do not, however, sum to unity as required, but this is not to be expected since they are no more than estimates of true coefficients -- that is, estimates which are subject to sampling error. Moreover, the addition of the rate of capacity utilization variable to represent the description of price determination in the competitive sector, supports the results.

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[208] V. Argy, "Structural Inflation in Developing Countries," *Oxford Economic Papers*, 22, (1970), pp. 76-83.

The coefficient of '$\dot{I}/I$' reproduces our expectation in that it is negative and less than unity in absolute terms. However, it is not equal numerically to the coefficient of '$\dot{W}/W$', but once again this is not to be expected in view of the fact that the numerical coefficients are estimates of the true coefficients only. However, we can test the hypothesis whether the coefficients of '$\dot{W}/W$' and '$\dot{I}/I$' are equal in absolute terms or alternatively, whether they sum to zero or not. That is we test:

$$H_0 : i_1^1 + i_1^2 = 0$$

against:

$$H_1 : i_1^1 + i_1^2 \neq 0$$

where $i_1^1=0.36$ and $i_1^2=-0.45$ represent, respectively, the coefficients of '$\dot{W}/W$' and '$\dot{I}/I$' in the estimated equation.

The statistic that we can use to test 'H_0' is:[209]

$$[(i_1^1+i_1^2)/s] \sim t(n-k)$$

where:

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[209] J. Kmenta, *Elements of Econometrics*, (New York: Macmillan, 1971), p.372.

$$s = [\ \mathrm{Var}(i_1^{1})+\mathrm{Var}(i_1^{2})+2\mathrm{Cov}(i_1^{1},i_1^{2})\ ]^{1/2}$$

and '$n-k=18-4=14$'. If the value of this statistic is significantly different from zero, the hypothesis that the two regression coefficients are equal (in absolute terms) is to be rejected.

Using the estimate of variance-covariance matrix of the estimated coefficients:

$$s = 0.125$$

and the 't' statistic would be:

$$t = (0.36-0.45)/(0.125) = -0.72$$

which is not significant. Therefore, the null-hypothesis (H_0) that the regression coefficients of '$\dot{W}/W$' and '$\dot{I}/I$' are equal in absolute terms is not rejected.

Finally, the coefficient of the rate of change of index of capacity utilization is significantly negative. This can be justified on the grounds that this variable represents movements along the representative short-run cost curve. By comparison, changes in wages and import prices represent shifts up or down of cost curves. The negative coefficient of the variable implies that, when short-run average costs fall as capacity utilization rises, prices do not rise so fast.

Taken at their face values, the estimated coefficients imply the following. First, that if the rate of increase of money wages rises by one point, the rate of increase of industrial prices will rise by just over one-third of one point. Secondly, that if the rate of increase in the import prices rises by one percent, the rate of increase of industrial prices will again rise by one-third of one percent. Thirdly, that if the rate of increase of real output per-man falls by one point, the rate of increase of industrial prices will rise by less than one-half of one point. Lastly, if the rate of increase of capacity utilization falls by one percent, the rate of increase of industrial prices will rise by almost one-fifth of one percent.

Thus, the rate of change of industrial prices in Iran appears to depend on the rates of change of money wages, real output per-man, import prices and capacity utilization index. This result compares favourably with the results based on single equation models of price mechanism of U. S. manufacturing sector performed by Siebert and Zaidi (1971),[210] and Askin and Kraft (1974),[211] of Britain by Dicks-Mireaux(1961)[212] and in a number of less developed countries by Glytses (1977).[213]

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[210] C. D. Siebert and M. A. Zaidi, "The Short-Run Wage-Price Mechanism in U. S. Manufacturing," *Western Economic Journal*, 9, (1971), pp.285-86.

[211] A. B. Askin and J. Kraft, *Econometric Wage and Price Models*, (London: Lexington Books, D. C. Heath Co., 1974), pp.57-59.

[212] L. A. Dicks-Mireaux, "The Interrelationship Between Cost and Price Changes, 1946-59: A Study of Inflation in Post-War Britain," *Oxford Economic Papers*, (October 1961), p. 281.

[213] N. P. Glytses, "Determinants of Wage and Price Changes in Less Developed Countries: An Intertemporal Cross-Country Analysis," *Journal of Development Economics*, 4, (1977), pp.323-27.

Rate of Change of Wage Equation

As empirical result for the wage equation (equation 4) in Table VI-5 shows, all variables have their hypothesised signs and all, except rate of change of import prices, have coefficients more than twice their standard errors. The coefficient of '$\dot{P}z/Pz$', however, is significant at 10 percent level, and the over all fit of the equation, as measured by 'R^2' is quite high at 97 percent.

In the literature, both linear and non-linear relationships have been postulated between unemployment rate and rate of change in money wages. In the United Kingdom, Lipsey (1960)[214] has found the relationship to be non-linear, while in the United States, with the exception of DeMenil (1969)[215] and Perry (1964, 1966, 1970),[216] a linear relationship has generally been employed. Modigliani and Tarantelli (1973)[217] in their study of Italy have employed a non-linear relationship. For the present study, the non-linear form was tried but the result was not good in the sense that the estimated coefficients were generally less significant. Hence, our choice.

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[214] R. G. Lipsey, "The Relationship Between Unemployment and the Rate of Change of Money Wage Rate in the United Kingdom, 1862-1957: A Further Analysis," *Economica*, 27, (February 1960), pp.1-31.

[215] G. DeMenil, "Nonlinearity in Wage Equation for U. S. Manufacturing," *Review of Economics and Statistics*, 15, (1969), pp. 202-206.

[216] G. L. Perry, "The Determinants of Wage Rate Changes and the Inflation-Unemployment Trade-off for the United States," *Review of Economic Studies*, (August 1964); and ———, *Unmployment, Money Wage Rates, and Inflation*, (Cambridge: The MIT Press, 1966), Chapters 1-3; and ———, "Inflation and Unemployment," in *Savings and Residential Construction: 1970 Conference Proceedings*, by D. P. Jacobs, ed., (Chicago: U. S. Savings and Loan League, 1970), pp. 30-45.

[217] Modigliani and Tarantelli (1973), op.cit., pp. 203-23.

Examination of the estimated wage equation shows that the predictions of the wage relationship model are supported by the Iranian data. The intercept has the right sign for a linear relationship and is highly significant. As expected, the coefficient of unemployment rate is negative and that of the rate of inflation positive but well below unity. The coefficient of rate of change of import prices and that of demand shift (S) variable are both positive and significant, although the demand shift variable seems to have a negligible effect on the rate of change of wages.

Taking the coefficients at their face values, they imply: (i) that if the rate of increase of prices rises by one point, the rate of change of money wages will rise by almost one-third of one point; (ii) that if the rate of increase of price of imports rises by one percent, the rate of money wages will increase by one-quarter of one percent; and (iii) that if the level of unemployment falls by one point, the rate of money wages will rise by almost three and a half points.

Our results are consistent with results of other studies of linear relationship between money wage rates and unemployment. For example Parkin (1970)[218] has tested the expectational model using the United Kingdom quarterly data relating to those quarters, in the entire period from the third quarter of 1948 to the first quarter of 1969, in which no incomes policy was in force ("Policy off" quarters in Parkin's terminology) and arrives at:[211]

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[218] M. Parkin, "Incomes Policy: Some Further Results on the Determination of the Rate of Change of Money Wages," *Economica*, (November 1970), pp. 389-93.

$$\dot{W}/W = 6.967 - 2.542U + 0.47\pi$$

Thus, on the basis of the Parkin's test, the expectational model for the "policy off" period is supported in part by the U. K. data in that the coefficient of 'U' and the intercept term have the right signs but, the coefficient of the expected rate of inflation , although with the right sign, is less than unity -- compared with our result above.

Rate of Change of Price Equation

The estimate of price equation (5) in Table VI-5 shows that the estimated coefficients of the equation have the expected signs and are significantly different from zero at 0.5 percent level. The equation also appears to be well specified with a fairly high 'R^2' equal to almost 92 percent. The regression was also run with a constant term included, but the estimated constant term -- an effect of time trend -- was found to be not significantly different from zero and hence was dropped.

The initial impact elasticity of rate of inflation with respect to the industrial prices is 1.09 which is not significantly different from unity and confirms the prediction of our model.

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[211] Ibid., Table 1.

The estimated value of the coefficient of the rate of change of relative price of agricultural products, 0.70, seems to support the food bottleneck hypothesis. This result compares favourably with Glytsos (1977)[220] analysis of price changes in 36 less developed countries (Iran included), who tries to test the general validity of different theoretical hypotheses on wage and price determination. The coefficient of food prices in Glytsos' estimate of pooled regression price change equation is 0.41, and grouping the countries into high- and low-income groups, the estimated values of 0.32 and 0.67, respectively, are obtained by him.[221]

Real Income (Demand for Money) Equation

As equations 6-a and 6-b of Table VI-5 show, the demand for real balances for narrow money (M1) as well as for broad definition of money (M2) is a stable function of real income and the rate of inflation. It is difficult to choose between the two specifications of the equation on the basis of the over all fit of the regressions since the 'R^2' is 0.99 for both definitions of money supply. Moreover, all of the coefficient estimates are significant at 0.5 percent level except the coefficient estimate of inflation rate in the narrow definition of money which is statistically significant at 2.5 percent level. The evidence of serial correlation was rejected at 1.0 percent level for the narrow definition and at 5 percent level for the broad definition of money. Therefore, it seems reasonable to argue that, in general, the equation for broad money is better determined than that for narrow definition, a result which is supported by the growing substitution from demand deposits to time and savings deposits in Iran during the period under study.

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[220] Glytsos (1977), op.cit., pp. 315-42.
[221] Ibid., pp. 326-29 and 337.

The theoretical basis of our model requires that, in the real income equation the coefficients of money and price level $(1/a_1)$ should be equal in numerical values, that is:

$$\text{Log}(Y) = -a_0/a_1 + 1/a_1\text{Log}(M) - 1/a_1\text{Log}(P) - a_2/a_1\pi$$

$$a_1>0,\ a_2<0$$

On the basis of the estimated results in Table VI-5, there is no reason to conclude that this constraint in the equation is not satisfied, given the fact that both of the coefficients are sufficiently well determined using both definitions of money.

Given the satisfactory statistical properties of these two regressions, we can now focus on the interpretation of the coefficients. The value of income elasticity of demand -- 'a_1', the reciprocal of the coefficient of Log(M) -- for narrow and broad definitions of money are 1.27 and 1.54 respectively. As expected, the income elasticity of broad money exceeds that of narrow money. This is the case for in less developed countries, transaction balances defined as 'M1' (narrow definition) tend to be more subject to economies of scale than money broadly defined (M2); and in addition, broad money appears to be considered more of a luxury good in these countries than in countries whose economic and financial systems are more developed. That is, in the absence of a well developed financial system the public in less developed countries tend to hold most of its savings in monetary forms.

These results are consistent with findings of other studies on less developed countries. Although observed long run income elasticities in developed countries are sometimes more and sometimes less than unity,[222] studies on less developed countries exhibit an income elasticity between the range 1.0 and 2.0. In a study of six Asian countries, Aghevli-et al. (1979)[223] reported elasticities ranging from 1.33 to 1.85 for a broad definition of money. Otani's (1975)[224] estimate of long-run income elasticity of demand for money in the Phillipines was about 1.46. However, Aghevli and Khan (1978),[225] in a study of Brazil, Colombia, Dominican Republic and Thailand found long-run income elasticities of demand for money (broadly defined) over quite a wide range -- 0.942 for Brazil to 2.147 for

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[222] See for example: D. K. Foot, "The Demand for Money in Canada: Some Additional Evidence," *Canadian Journal of Economics*, X, No.3, (August 1977), p. 483; and K. Clinton, "The Demand for Money in Canada, 1955-1970: Some Single Equation Estimates and Stability Tests," *Canadian Journal of Economics*, VI, No. 1, (February 1973), p. 57.

[223] B. B. Aghevli, M. S. Khan, P. R. Narvekar, and B. K. Short, "Monetary Policy in Selected Asian Countries," I. M. F., *Staff Papers*, 26, (December 1979), pp. 775-824.

[224] I. Otani, "Inflation in an Open Economy: A Case Study of Phillipines," I. M. F., *Staff Papers*, 22, (1975), pp. 750-74.

[225] B. B. Aghevli and M. S. Khan, "Government Deficits and the Inflationary Process in Developing Countries," I. M. F., *Staff Papers*, 25, (September 1978), pp. 383-416.

Dominican Republic. Galbis (1979)[226] in his study of 19 Latin American countries, estimated elasticities which were generally below unity and quite dispersed over a wide range. This is probably not surprising given the disturbed monetary experience of a number of Latin American countries.[227] Crockett and Evans (1980)[228] in their recent study on the demand for money in Middle East (including Iran) estimated a range of 1.0 and 1.50 for the income elasticity of demand for narrow money for all countries studied except Lebanon; and for the broad definition, only Qatar exhibited an income elasticity outside the range of 1.25 and 1.50. Their estimated demand for money in Iran, using real non-oil gross domestic product and implicit non-oil GDP deflator as proxies for real income and price level respectively, showed an income elasticity of demand for money equal to 1.15 and

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[226] V. Galbis, "Money, Investment, and Growth in Latin America, 1961-1973," *Economic Development and Cultural Change*, 27, (April 1979), pp. 423-43.

[227] For other studies on Latin America see: J. A. Hanson, "The Short-Run Relation Between Growth and Inflation in Latin America: A Quasi-Rational or Consistent Expectations Approach," *American Economic Review*, 70, (December 1980), pp. 972-89; and J. V. Deaver, "The Chilean Inflation and the Demand for money," in *Varieties in Monetary Experience*, by D. Meiseleman, ed., (Chicago: University of Chicago Press, 1970), pp. 9-67; also A. C. Diz, "Money and Prices in Argentina, 1935-62," in Meiseleman (1970), ibid., pp. 69-161; and A. C. Harberger, "The Dynamics of Inflation in Chile," in *Measurement in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yehudi Gruenfeld*, by C. Christ, ed., (Stanford: Stanford University Press, 1963), pp. 219-50.

[228] A. D. Crockett and O. J. Evans, "Demand for Money in Middle Eastern Countries," I. M. F., *Staff Papers*, 27, (September 1980), pp. 543-77.

1.44 for narrow and broad definitions of money respectively.[229]

It should be mentioned that, given the absence of a variable in order to capture the monetization effect -- that is, the effect of enlargement of money economy through the absorption of the non-monetized sector -- the estimated income elasticity of demand for money in our model (1.27 for narrow and 1.54 for broad definitions of money) includes this effect. Therefore, the estimates are probably biased upward. Although some attempts are described in Chandavarkar (1977),[230] there has generally been little success in obtaining a suitable proxy to isolate the monetization effect.

The influence of inflation in the estimated equation 6 in Table VI-5 above supports the hypothesis that the demand for money is sensitive to the expected rate of inflation. The opportunity cost coefficients (a_2) in both equations (6-a and 6-b) have the correct signs and are well within the range suggested in other studies available. Money demand studies in advanced countries suggest an opportunity cost elasticity of between -0.2 and -0.8 in general. In Iran, our estimates show that this elasticity using the narrow definition of money is -0.44 ($a_2/a_1=0.35$) and that of the broad definition of money is estimated at -0.63

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[229] Ibid., Table 1, p. 554 and pp. 566-67.
[230] A. G. Chandavarkar, "Monetization of Developing Economies," I. M. F., *Staff Papers*, 24, (November 1977), pp. 665-721.

($a_2/a_1=0.41$). These estimates compare favourably with other studies available. Crockett and Evans (1980),[231] for example, estimate the inflation elasticity of demand for money in Iran to be almost -0.7 for both definitions of money (M1 and M2). Hu (1971)[232] in his study of demand for money in China, estimated the opportunity cost elasticity to fall within the range of -0.60 and -0.82. And Otani (1975)[233] finds an inflation elasticity of money demand equal to -0.35 for the Phillipines.[234]

Other experiments with lag structure were also conducted on the demand for money equation, using a partial adjustment or error-learning process model. The desired demand for real balances was specified in log-linear form as:

$$\text{Log}(M/P)^* = a_0 + a_1\text{Log}(Y) + a_2\pi \qquad \text{(I)}$$

$$a_1>0,\ a_2<0$$

where '*' denotes desired demand and other variables are defined earlier. Then, it was assumed that the actual stock of real money balances adjust proportionally to the difference between the demand for real money balances and the actual stock in the previous period. That is:

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[231] Crockett and Evans (1980), op.cit., pp. 566-67.

[232] T. W. Hu, "Hyperinflation and the Dynamics of the Demand for Money in China, 1945-49," *Journal of Political Economy*, 79, (January-February 1971), pp. 186-95.

[233] Otani (1975), op.cit., p. 758.

[234] Other relevant studies on demand for money include: A. Hynes, "The Demand for Money and Monetary Adjustments in Chile," *Review of Economic Studies*, 34, (July 1967), pp. 285-93; J. O. Adekunle, "The Demand for Money: Evidence for Developed and less Developed Economies," I. M. F., *Staff Papers*, 15, (July 1968), pp. 220-66; L. S. Fan and Z. R. Liu, "Demand for Money in Asian Countries: Empirical Evidence," *Indian Economic Journal*, 18, (April-June 1971), pp. 475-81; and C. H. Wong, "Demand for Money in Developing Countries: Some Theoretical and Empirical Results," *Journal of Monetary Economics*, 3, (January 1977), pp. 59-86.

$$\Delta \mathrm{Log}(M/P) = \lambda\, [\mathrm{Log}(M/P)^* - \mathrm{Log}(M/P)_{-1}\,];\ 0< \lambda <1 \quad \text{(II)}$$

where 'λ' denotes the coefficient of adjustment and 'Δ' is the difference operator. Substituting I into II and solving for the level of real income, yields:

$$\begin{aligned}\mathrm{Log}(Y) = {} & -a_0/a_1 + 1/\lambda a_1 \mathrm{Log}(M/P) - a_2/a_1 \pi \\ & -(1-\lambda)/\lambda a_1 \mathrm{Log}(M/P)_{-1} \qquad \text{(III)}\end{aligned}$$

The simultaneous estimation result of III for both definitions of money are as follows:

Narrow definition:

$$\begin{array}{llllll}\mathrm{Log}(Y) = & 3.08 & + 0.56\mathrm{Log}(M1/P) & + 0.34\mathrm{Log}(M1/P)_{-1} & + 0.33(\dot{P}/P) \\ & (5.97) & (2.81) & (1.58) & (1.61)\end{array}$$

$$R^2 = 0.98,\ \mathrm{D.W.} = 1.07$$

Broad definition:

$$\begin{array}{llllll}\mathrm{Log}(Y) = & 4.99 & + 0.45\mathrm{Log}(M2/P) & + 0.25\mathrm{Log}(M2/P)_{-1} & + 0.34(\dot{P}/P) \\ & (18.44) & (4.59) & (2.39) & (1.76)\end{array}$$

$$R^2 = 0.97,\ \mathrm{D.W.} = 1.36$$

In general, the results are not good compared to equations 6-a and 6-b of Table VI-5. First, the coefficients of lagged real money balances have the wrong signs, suggesting, possibly, an adjustment coefficient greater than unity. Secondly, the coefficients of inflation rate are not statistically significant even at 10 percent level. Finally, the explanatory powers of these equations have been reduced slightly and the Durbin-Watson statistic in both equations point to evidence of serial correlation.

It should be added that the formulation of the adjustment mechanism (equation II) involves the assumption that a reduction in the real value of the nominal money stock owing to rising prices is subject to immediate adjustment. White (1978)[235] suggests an alternative formulation whereby the stock adjustment transformation is specified in nominal terms. That is:

$$\Delta \mathrm{Log}(M) = \lambda[\mathrm{Log}(M)* - \mathrm{Log}(M)_{-1}];\ 0 < \lambda < 1 \qquad \text{(IV)}$$

Substituting I into IV:

$$\mathrm{Log}(Y) = -a_0/a_1 + 1/\lambda a_1 \mathrm{Log}(M/P) - a_2/a_1 \pi - (1-\lambda)/\lambda a_1 \mathrm{Log}(M_{-1}/P) \qquad \text{(V)}$$

Equation V is the same as equation III except the last term on the right hand side of the equation is not the usual lagged real balances variable. Experiments along this line were also performed but did not produce better results in that the over all fit was poorer than the other forms and the implied elasticities assumed implausible values.

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[235] W.H. White, "Improving the Demand for Money Function in Moderate Inflation," I. M. F., *Staff Papers*, 25, (September 1978), PP. 570-73.

Money Supply Equation

As estimated versions of equation 8, for both narrowly and broadly defined money supply, in Table VI-5 show, all the coefficient estimates have the predicted signs and the estimates are all greater than their respective standard errors.

The coefficient of the lagged dependent variables in both equations are, as expected, not significantly different from unity at 0.5 percent level. The results also show the proportion of the government budgetary deficit which are financed by new money creation as well as the extent of the balance of payments surplus which has become monetized in Iran.

Comparison of our results with other studies on less developed countries -- de Silva (1977)[236] and Aghevli and Khan (1978)[237] -- reveals that a lower proportion of government deficits in Iran have been financed through new money creation than those of Sri-Lanka, Brazil, Colombia, Dominican Republic and Thailand. This may be accounted for the fact that the government in Iran is the main recipient of the huge oil revenues of the country.

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[236] K.E.A. de Silva, "Money Supply, Inflation and the Balance of Payments in Sri-Lanka (1959-74)," *Journal of Development Studies*, 13, (January 1977), p. 31.

[237] Aghevli and Khan (1978), op.cit., pp. 395-98.

Government Expenditures Equation

In reference to equation 10 in Table VI-5 above, all the parameters in the government expenditure equation have the expected signs and all are significant at 5 percent level. Based on the estimated coefficients, the values of the parameters of the equation are as follows:

$1-\delta = 0.46$, or $\delta = 0.54$

$\delta g_0 = -6.27$, or $g_0 = -11.61$

$\delta g_1 = 0.95$, or $g_1 = 1.76$

The coefficient of adjustment of government expenditures is 0.54 which indicates that 54 percent of the gap between the desired level of real government expenditures in the current period and the actual level of real expenditures in the previous period is adjusted within one year, and that it would take about four years before 95 percent of the gap is closed.

The effect of real income on government expenditures in the short-run, $\delta g_1 = 0.95$, is positive and close to unity. This implies that the government expenditures move proportionally with the rise in real income in the short-run. However, the long-run income elasticity of government expenditures, $g_1 = 1.76$, is well above unity implying that as income increases these expenditures rise more than proportionally.

Our results are partially supported by what is available in the literature concerning the less developed countries. Aghevli and Khan (1978)[238] have estimated long-run income elasticities of government expenditures for Colombia and Thailand to be 1.34 and 1.70 respectively, while their estimates for Brazil and Dominican Republic are not significantly different from unity. However, their estimates of coefficient of adjustment of government expenditures are not significantly different from unity for all four countries they studied.

The specification of our adjustment mechanism for real government expenditures -- as mentioned in the previous chapter -- involves the assumption that the government authorities, in the face of inflation, attempt to keep their real expenditures constant. And only if the coefficient of adjustment approaches unity can one hypothesise that nominal government expenditures as well adjust upward automatically to keep pace with inflation. Our estimate of '$\delta = .54$' above which is lower than unity refutes this hypothesis contrary to that of Aghevli-Khan (1978) mentioned earlier. Therefore, we conducted an estimate of the government expenditures equation using nominal adjustment function. The result is as follows:

$$\underset{}{\mathrm{Log}(G/P)} = \underset{(-7.68)}{-15.56} + \underset{(2.61)}{1.56\mathrm{Log}(Y)} + \underset{(0.17)}{0.005\mathrm{Log}(G_{-1}/P)}$$

$$R^2 = 0.99,\ \mathrm{D.W.} = 1.63$$

As the results indicate, the coefficient of lagged dependent variable is insignificant and nothing can be deduced concerning the value of the coefficient of adjustment.

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[238] Ibid., pp. 397-8.

Government Revenue Equation

As equation 11 in Table VI-5 above shows, all the coefficient estimates have the predicted signs. The estimates of coefficients of nominal income and lagged dependent variable are statistically significant at 10 and 0.5 percent levels, respectively. The values of individual parameters of the equation, the value of the adjustment coefficient and the equilibrium or long-run value of relevant elasticity are as follow:

$1-\eta = 0.78$, or $\eta = 0.22$

$\eta r_0 = -2.95$, or $r_0 = -13.41$

$\eta r_1 = 0.30$, or $r_1 = 1.36$

The results indicate that, the adjustment coefficient of domestic government revenues is 0.22 which lies outside the range found for other less developed countries by Aghevli and Khan (1978), that is between 0.62 and 0.85, although they acknowledge the possibility that their results are biased upward.[239] As expected, the coefficient of adjustment for government revenues is smaller than the adjustment coefficient of government expenditures estimated earlier to be 0.54. This supports our hypothesis that the government deficit is a function of increase in the level of prices, implying that, even though the government authorities may set the targets of expenditures and revenues to match, an increase in inflation will produce a deficit in the government budget. Thus, our view that one of the reasons for the existence of two-way causality between money and prices depends crucially on a shorter time lag in the adjustment of government expenditures than in the adjustment of government revenues is empirically verified.

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[239] Ibid., p. 397.

Although the short-run effect of income on domestic government revenues is 0.30, the long-run income elasticity of revenues exceeds unity -- r_1=1.36 -- which implies that as income increases, domestic revenues of the government rise more than proportionally. This result compares favourably with the income elasticities estimated for other less developed countries. Aghevli and Khan (1978)[240] report an income elasticity of government domestic revenues in the range of 1.00 and 1.20 for their study of four less developed countries. Aghevli (1977)[241] has estimated the Indonesia's income elasticity of domestic government revenues to be 1.325. Chelliah (1971)[242] in his study of a total of 27 less developed countries finds that the average income elasticity of total tax revenues for the whole group is 1.4.

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[240] Ibid., pp. 397-98.

[241] B.B. Aghevli, "Money, Prices and the Balance of Payments: Indonesia 1968-73," *Journal of Development Studies*, 13, (January 1977), pp. 37-57.

[242] R. J. Chelliah, "Trends in Taxation in Developing Countries," I. M. F., *Staff Papers*, 18, (July 1971), PP.758-60.

Imports Equation

As the imports equation 13 in Table VI-5 shows, the three explanatory variables namely, real income, relative import prices and lagged volume of imports all have coefficients with the expected signs. The coefficient estimates of real income and lagged dependent variable are significantly different from zero at one percent level and that of relative prices is significant at 5 percent level. The equation appears to be well specified with 'R^2=0.99' and no evidence of significant autocorrelation. The estimated values of the coefficients of imports equation are as follows:

$1-\mu = 0.44$, or $\mu = 0.56$
$\mu z_0 = -2.85$, or $z_0 = -5.09$
$\mu z_1 = 0.89$, or $z_1 = 1.59$
$\mu z_2 = -0.57$, or $z_2 = -1.02$

The coefficient of lagged volume of imports, 0.44, suggests that the adjustment coefficient is 0.56 which indicates that more than half of the gap between the desired level of real imports demanded in the current period and the actual level of imports in the previous period is adjusted within a year. This implies that it would take about four years before 95 percent of the gap between the desired level of real imports in the current period and the actual flow in the previous year could be eliminated.

The income elasticity of imports in the short-run is 0.89, while the long-run elasticity is 1.59 which is consistent with many other empirical findings for the less developed countries. This indicates that the demand for imports rises more than proportionally as income rises in Iran. The relative price elasticity of imports in the long-run, -1.02, is not significantly different from unity which again compares favourably with other studies. Otani (1975)[243] in his study of the Phillipines estimates that the long-run income and relative price elasticities of demand for imports to be 1.50 and 0.90 respectively, while the coefficient of adjustment in his model is estimated to be about 70 percent. Otani and Park (1976)[244] estimated the long-run price and income elasticities of demand for imports of consumer goods in the Korean economy to be 0.61 and 1.78 respectively with a coefficient of adjustment of 65 percent. They also estimated the imports of intermediate goods in Korea and found an income elasticity of demand equal to 1.28 and a coefficient of adjustment of more than 90 percent.[245] This high speed of adjustment for the import demand for intermediate goods was justified on the grounds of the government of Korea's adoption of flexible import control policies to allow import of necessary intermediate goods to maintain a certain level of output. Finally, Aghevli's (1977)[246] study of Indonesia report the estimated income and price elasticities of imports of 2.317 and 1.107

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[243] Otani (1975), op.cit., pp.758-60.

[244] I. Otani and Y. C. Park, "A Monetary Model of the Korean Economy," I. M. F., *Staff Papers*, 23, (1976), pp. 177-79.

[245] Ibid., pp. 46-7.

[246] Aghevli (1977), op.cit., pp. 46-7.

respectively.

Unemployment Equation

In reference to equation 14 in Table VI-5 above, it appears that, in Iran, the excess demand measured by the deviation of real income from its full-employment level is related to the unemployment rate. The coefficient of excess demand is significantly different from zero at 10 percent level and the over all fit of the regression is fairly good at 93 percent. There is, as well, no evidence of serial correlation at 2.5 percent level.

The results imply that an increment of unemployment by one percent is associated with an output loss equal to almost 1.5 percent decrease in real income. This result is lower than 2.8 percent figure arrived at by Okun (1970).[247] But given the fact that the Iranian economy has been operating at near full employment, this result seems plausible. Also the estimated unemployment rate associated with a zero gap is 0.25 percent which is, however, well below the ideal rate of between 3 and 4 percents.

E. Summary

The aim of this chapter was to clarify and to test aspects of the structuralist and monetarist theories of inflation. The results obtained do not generally contradict the hypotheses tested.

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[247] A. Okun, *The Political Economy of Prosperity*, (Washington D. C.: The Brookings Institution, 1970), p. 136.

The first structuralist position adopted was a hypothesis in the computation of the required rates of growth of agricultural production (A*) for price stability based on both presumed as well as estimated income elasticities of demand for food (Chapter V). An additional element in this classification was the separation of trend and price-induced components in the increase in agricultural output which is consistent with the structuralist position, but represents a specific clarification which is not present in the structuralist literature explicitly.

It was found, by the criteria used, that agricultural output in Iran failed to expand at a rate even close to the required rates of growth for price stability. The direction of the relationship is the one which is indicated by the structuralist theory in that less adequate food production means relative rises in the price of food and hence more inflation.

The integrated structuralist-monetarist model of inflation developed in Chapter V was estimated using annual data for the Iranian economy for the period 1959-1977. The empirical results of the study support a broad model of inflation for Iran. The formulated structural part of the model is substantially supported by the finding of significant coefficients with expected signs in the relative price of food, industrial price and wage equations. However, the finding of significant coefficients with anticipated signs in the demand for money equation as well as government expenditures and government revenues equations are consistent with the monetarist argument in that excessive aggregate demand is also responsible for inflation in Iran.

Some of our main results, relevant to the structuralist-monetarist controversy, can be summarized as follows. Food prices have considerable impact on inflation in Iran. Our results seem to support, in addition to the above mentioned test for inadequacy of agricultural production, the structuralist food bottleneck hypothesis in that food prices explain a greater percentage of the variation in the general price level.

According to our results, there exists a relation between wage and price changes. Changes in industrial prices are associated with wage rate changes with a regression coefficient of 0.36. To establish a price-wage spiral of inflation would normally require dynamic relations with lags. Though our wage and price equations do not include lagged variables, they demonstrate a substantial mutual association between the two variables. The wage coefficient, along with that of import prices, at least suggests that changes in industrial prices and hence, rate of inflation and wage rate changes move together, but wage changes are not fully transmitted to price changes. Import prices are also significantly related to the general price level via their significant impact on both industrial prices and wages. These results, in conjunction with the finding that food prices have an effect on prices in Iran, seem to give some empirical weight to the structuralist explanation of inflation.

It is obvious that there must be an effective transmission or propagation mechanism which allows the manifestation of the various inflationary pressures if the structural constraints are to give rise to price increases. The second part of our model examined the nature of this propagation mechanism in the process of inflation, that is, the existence of a two-way causality between money and prices. This was done by hypothesizing that a higher price level tends to increase nominal government expenditures faster than government revenues which was empirically verified. The resultant budget deficits in addition to the balance of payments surplus then increases the money supply and induces further inflationary pressures which is consistent with the monetarist argument that excessive aggregate demand is responsible for inflation.

The implications of this discussion are that, even without an exogenous increase in money supply, inflation may generally be fed by food and import prices as well as wage rises. Consequently, assuming that increase in money supply is mostly the result of deficit financing, our findings are in accord with Lewis' claim that " ... if one eliminated the budgetary deficit, prices would not rise so fast, but the wage-price spiral could still be there just as it exists in many advanced industrial countries which have no budget deficit."[248] Therefore our results favour the integrated model of inflation. Although, on the one hand, they point to the structuralist position, the causes of inflation are not demonetized since money, as it should be expected, is in the picture.

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[248] Arthur W. Lewis, "Closing Remarks," in *Inflation and Growth in Latin America*, by W. Bauer and I. Kerstenetzky, eds., (New Haven: Yale University Press, 1964), p. 24.

VII. THE USE OF THE MODEL FOR ANALYTICAL AND POLICY PURPOSES

The model developed in Chapter V and empirically tested in Chapter VI points out the direct determinants of economic behaviour in Iran. The version of the model in which current endogenous variables appear as functions of all of the predetermined variables is called the reduced form of the model. The parameters of such a reduced form, called the reduced-form parameters, provide estimates of the direct and the indirect influence of each predetermined variable on each of the current endogenous variables. The reduced form of the model is a tool employed to elaborate the four primary themes of this chapter. Derivation of the reduced form and discussion on the elasticity multipliers are the subjects of the first and second sections. In the third section a dynamic simulation analysis of the model is performed while, the last section of the chapter deals with the use of the model for policy shock analysis.

A. The Reduced Form of the Model

The model presented in Chapters V and VI can be written in matrix form as follows:

$$AY + BY(-1) + CX = U$$

where 'Y' is a column vector of endogenous variables (13x1); 'Y(-1)' is a column vector of lagged endogenous variables (6x1); 'X' is a column vector of exogenous variables (12x1); and 'U' is a column vector of error terms (13x1). The 'A' matrix is the coefficient matrix of the endogenous variables (13x13); 'B' is the coefficient matrix of lagged endogenous variables (13x6); and 'C' is the coefficient matrix of exogenous variables (13x12). Since the first half of the model is in rates of change while the second half is in level form, a linear approximation in growth rates of the level variables was obtained by differentiating the corresponding equations with respect to time (see Appendix II).

By arranging the variables in such a way that the endogenous variable in each equation appears on the left-hand side of it and the predetermined variables appear on the right-hand side, the model can be written in the following form:

$$AY = -BY(-1) - CX + U$$

Then, the reduced form of the structural equations is:

$$Y = DY(-1) + EX + V$$

where:

$$D = -A^{-1}B$$

$$E = -A^{-1}C$$

$$V = A^{-1}U$$

B. Elasticity Multipliers

In order to get an idea of total -- direct and indirect -- impact of each of the predetermined variables on the endogenous variables, the reduced form of the model derived in the previous section is employed. For this purpose, we use the reduced form equations in the following way:

$$Y = [E^*|D^*][X|Y(-1)]$$

where [E*|D*] is called the multiplier matrix (13x18) and '*' indicates the estimated values of the parameters (Chapter VI). The reduced form results of this multiplier matrix are presented in Table VII-1. The multiplier matrix registers the responsiveness of the endogenous variables to changes in any of the eighteen predetermined variables, with all other predetermined variables held constant -- that is elasticity multipliers. Column-wise, the impact of any predetermined variable on each current endogenous variable can be read. Row-wise, the elements of each row of the multiplier matrix are the partial derivatives of the endogenous variable with regard to different predetermined variables.

By comparing the structural parameter estimates of Table VI-5 with corresponding reduced form parameter estimates of Table VII-1, it is evident that the responsiveness of almost all endogenous variables to changes in predetermined variables have mostly been enhanced or at least remained constant. This means that, when both direct and indirect effects of predetermined variables are taken into account, the variables have greater responsiveness than when only the direct effects are considered.

An examination of the first five rows of Table VII-1 reveals that the responsiveness of both agricultural and industrial prices to changes in population has been

Table VII - 1

Reduced Form Linear Approximation of the Model*

Endogenous Variables	Predetermined Variables																	
	1	$\dot{N}/N$	A	$\dot{I}/I$	$\dot{Cu}/Cu$	$\dot{S}/S$	$\dot{P}_z/P_z$	$d(\dot{p}/p)$	$\frac{\dot{XPX}}{XPX}$	$\frac{\dot{Xoil Poil}}{Xoil Poil}$	$\frac{\dot{K}}{K}$	$\frac{\dot{YF}}{YF}$	$(\frac{\dot{P}}{P})_{-1}$	U_{-1}	$(\frac{\dot{M}}{M})_{-1}$	$(\frac{\dot{G}}{G})_{-1}$	$(\frac{\dot{R}}{R})_{-1}$	$(\frac{\dot{Z}}{Z})_{-1}$
$\dot{F}/F$	0.55	0.31	-0.35	0.03	0.01	0.0	-0.03	0.0	0.0	0.02	0.03	-0.05	0.0	0.05	0.08	0.01	-0.01	-0.01
$\dot{Pa}/Pa$	21.86	0.66	-0.75	-0.97	-0.32	0.08	1.22	-0.01	0.05	0.26	0.32	1.46	0.15	-2.17	0.51	-0.15	0.09	0.04
$\dot{Pi}/Pi$	21.31	0.36	-0.40	-0.99	-0.30	0.08	1.25	-0.01	0.05	0.28	0.35	1.49	0.16	-2.22	0.46	-0.16	0.09	0.04
$\dot{W}/W$	32.76	0.86	-0.97	-1.57	-0.48	0.22	2.50	-0.03	0.15	0.38	0.42	4.65	0.44	-9.33	0.83	-0.44	0.25	0.11
$\dot{P}/P$	23.61	0.60	-0.68	-1.32	-0.28	0.08	1.34	-0.01	0.06	0.32	0.39	1.27	0.17	-2.85	0.75	-0.17	0.10	0.04
$\dot{Y}/Y$	-13.79	-0.35	0.40	0.77	0.17	-0.05	-0.80	0.01	0.06	0.33	0.39	-0.90	-0.17	1.27	1.26	0.17	-0.10	-0.04
$\dot{M}/M$	1.67	0.04	-0.05	-0.09	-0.04	0.0	-0.07	0.0	0.03	0.19	0.22	0.41	-0.08	-0.25	1.05	0.19	-0.11	-0.08
$\dot{D}/D$	14.36	0.36	-0.41	-0.80	-0.34	0.05	0.79	0.0	0.0	0.0	-0.04	1.47	-0.68	-2.15	-0.14	0.68	-0.39	0.0
$\dot{G}/G$	10.51	0.27	-0.30	-0.59	-0.25	0.04	0.58	0.0	0.0	-0.03	-0.03	1.08	-0.45	-1.61	-0.09	0.45	0.0	0.01
$\dot{R}/R$	2.95	0.08	-0.08	-0.16	-0.07	0.01	0.16	0.0	0.0	0.0	0.0	0.30	0.0	-0.45	0.01	0.0	0.78	0.0
$\dot{BP}/BP$	-0.51	-0.01	-0.01	0.02	0.03	0.01	-0.21	0.0	0.0	0.63	0.70	-0.05	0.02	0.08	-0.32	-0.06	0.01	-0.18
$\dot{Z}/Z$	1.18	0.03	-0.03	-0.07	-0.03	0.0	-0.52	0.0	0.0	0.20	0.23	0.12	-0.06	-0.18	0.74	0.13	-0.08	0.43
U	-9.24	-0.24	0.27	0.52	0.22	-0.03	-0.54	0.01	0.01	0.10	0.11	-1.62	-0.12	2.41	1.51	0.12	-0.07	-0.03

* All figures represent elasticities of endogenous variables with respect to predetermined variables, except for $d(\frac{\dot{P}}{P})$.

Source: See the text.

enhanced. Moreover, these two price indices as well as the general price level and the index of wage rate are elastic with respect to any changes in the import prices. This means that if the rate of change of import prices increases by one percent, rates of change of both agricultural and industrial prices would increase by about 1.25 percent, the rate of inflation by 1.34 percent, while the rate of change of the index of money wage rates would increase by 2.50 percentage points. The rise in the magnitude of the import price elasticity of industrial prices as compared to structural coefficient may be due to the negative feedback effect of a decline in output.

The negative effect of the rate of growth of output per-person on industrial prices has doubled compared to the result obtained by structural coefficients (the elasticity is almost one) and it has almost the same effect on agricultural prices, while the responsiveness of both wage rates and the general level of prices turned out to be quite elastic with respect to this exogenous variable. In addition, the trend rate of growth of output in agricultural sector has a considerable negative impact on all of these endogenous variables -- the elasticities being -0.75 for agricultural prices, -0.40 for industrial prices, -0.68 for general price level and -0.97 for money wages. Finally, lagged rate of growth of money supply and especially lagged unemployment rate appear to have great positive and negative effects, respectively, on these endogenous variables as expected.

These findings suggest that policies which are aimed at reducing the growth rate of population and those directed towards raising output per-person in industrial sector as well as increasing output in the agricultural sector appear to be in the right direction.

Real income has turned out to be elastic with respect to one period lagged money supply with elasticity equal to 1.26. At the same time other variables with considerable positive effect on the rate of change of real income include the rate of growth of output per-person in industrial sector, the trend rate of growth of output in agricultural sector as well as the growth rate of export of oil. Rate of growth of import prices, on the other hand, has a considerable negative impact on the rate of growth of real income -- the elasticity is 0.80.

Major changes in the rate of growth of money supply is explained by its lagged values. However, the rates of change of value of oil exports as well as changes in capital inflows do have some effect on the rate of change of money supply as expected.

Column-wise, the effects of an increase in the value of oil exports due to higher demand as well as higher oil prices is shown in the tenth column of Table VII-1. As expected, it affects different price indices; elasticities are 0.26 for the food prices, 0.28 for the industrial prices, 0.32 for the general price level and 0.38 for the wage rate. In addition, it has almost the same effect on the rate of growth of real income with an elasticity equal to 0.33. A rise in capital inflows (an improvement in balance on capital account) has almost the same effect on endogenous variables as does export of oil, both as the direction of impact as well as the magnitude of elasticities are concerned.

That in this section we could assess the direct and indirect effects of predetermined variables on endogenous variables using the reduced form result of the structural equations argues for simultaneous equation estimation whenever applicable since in single equation estimation only the direct effects can be analysed.

C. Simulation Analysis of the Model

The value of simulation analysis is well known. First, it can provide a test for validity of the model. Once the model is accepted as reasonable in reflecting the economic reality, the simulation analysis can reveal many economic policy control properties of the model. Secondly, simulation results may reveal mathematical properties of the model. Finally, there may also be problem areas that can be improved for a better specification of the model.

In order to examine how well the model as a whole traces actual movements in the Iranian economy, we carried out a simulation exercise by making use of the reduced form of the structural equations, together with the estimated coefficients. A dynamic simulation was then constructed in which the values of the lagged endogenous variables were themselves generated by the simulation process.

In our simulation, we use the reduced form equations, derived in the first section of this chapter, in the following way:

$$Y^* = (D^*)Y^*(-1) + (E^*)X$$

where '*' indicates the estimated, or predicted, values of the parameters and variables.

The comparison between the actual values and the simulated values of the endogenous variables can be viewed as a test of the goodness of fit of the complete model, somewhat analogous to the calculation of 'R^2' in single equations. In addition, by allowing the lagged endogenous variables to be determined within the simulation, the dynamic simulation can also be used as a test of stability of the estimated model.

The method of simulation is to multiply the estimated coefficient matrices (D^* and E^*) by the predicted values of lagged endogenous variables and by the actual values of all the exogenous variables. The results represent the simulated values of all the endogenous variables of the model. Figures 1 through 13 show the actual and simulated values of the endogenous variables in terms of percentage changes for the period 1961-1977 and Table VII-2 records the values of these simulated variables for the same period.

Table VII - 2

Simulation I: Simulated Values of Dependent Variables

	$\frac{\dot{F}}{F}$	$\frac{\dot{Pa}}{Pa}$	$\frac{\dot{Pi}}{Pi}$	$\frac{\dot{P}}{P}$	$\frac{\dot{W}}{W}$	U	$\frac{\dot{Y}}{Y}$	$\frac{\dot{M}}{M}$	$\frac{\dot{D}}{D}$	$\frac{\dot{G}}{G}$	$\frac{\dot{R}}{R}$	$\frac{\dot{BP}}{BP}$	$\frac{\dot{Z}}{Z}$
1961	1.43	11.66	10.23	10.74	29.12	0.14	2.50	14.32	10.86	14.43	21.42	- 8.76	- 0.53
1962	-0.10	-10.82	-10.72	-10.16	-17.83	-17.58	11.82	-15.17	- 8.83	- 3.34	7.42	45.79	- 4.21
1963	0.72	- 1.89	- 2.61	- 1.88	2.58	24.53	6.45	32.82	19.77	13.74	1.93	22.53	- 6.81
1964	-1.28	1.99	3.27	2.06	16.28	6.47	14.31	16.62	19.26	16.59	-11.37	3.47	- 1.50
1965	-0.92	0.97	1.90	1.05	14.39	2.89	6.51	13.57	21.12	11.19	- 8.28	-24.02	11.27
1966	0.10	- 2.83	- 2.93	- 2.68	6.94	6.98	10.15	16.63	18.63	20.74	24.89	14.64	13.24
1967	-0.53	11.10	11.62	10.51	37.06	- 4.88	4.90	12.74	23.37	33.99	54.82	12.77	3.71
1968	-2.06	- 5.52	- 3.46	- 4.88	7.02	10.11	10.46	19.49	22.71	20.87	17.26	- 4.51	9.43
1969	-0.52	5.42	5.94	5.17	22.00	- 3.33	5.10	9.76	22.15	21.50	20.22	9.23	7.67
1970	-1.89	3.04	4.93	3.14	21.96	- 5.97	9.15	7.76	18.16	15.91	11.52	39.63	4.15
1971	1.30	2.08	0.78	1.76	19.91	8.37	12.02	17.15	25.52	23.77	20.33	65.43	4.52
1972	-2.05	- 1.32	0.73	- 0.93	15.21	12.72	8.62	22.88	24.63	22.74	19.05	-18.57	4.87
1973	-2.63	17.36	19.98	16.71	83.83	24.64	1.16	43.37	41.86	36.08	24.76	62.99	1.51
1974	-3.33	8.52	11.85	8.51	59.16	20.43	5.37	36.75	37.76	33.83	26.11	324.63	5.40
1975	1.14	20.42	19.28	19.02	51.61	21.58	- 4.41	42.14	130.43	95.47	26.94	-28.05	10.25
1976	-6.25	- 4.00	2.25	- 2.82	14.38	11.61	10.27	22.16	- 5.97	17.74	64.23	8.33	13.93
1977	2.41	26.53	24.12	24.58	57.67	28.28	- 8.46	50.08	39.39	35.85	28.89	-44.92	4.30

Source: See the text.

Figure 1

Simulation I: $\dot{F}/F$

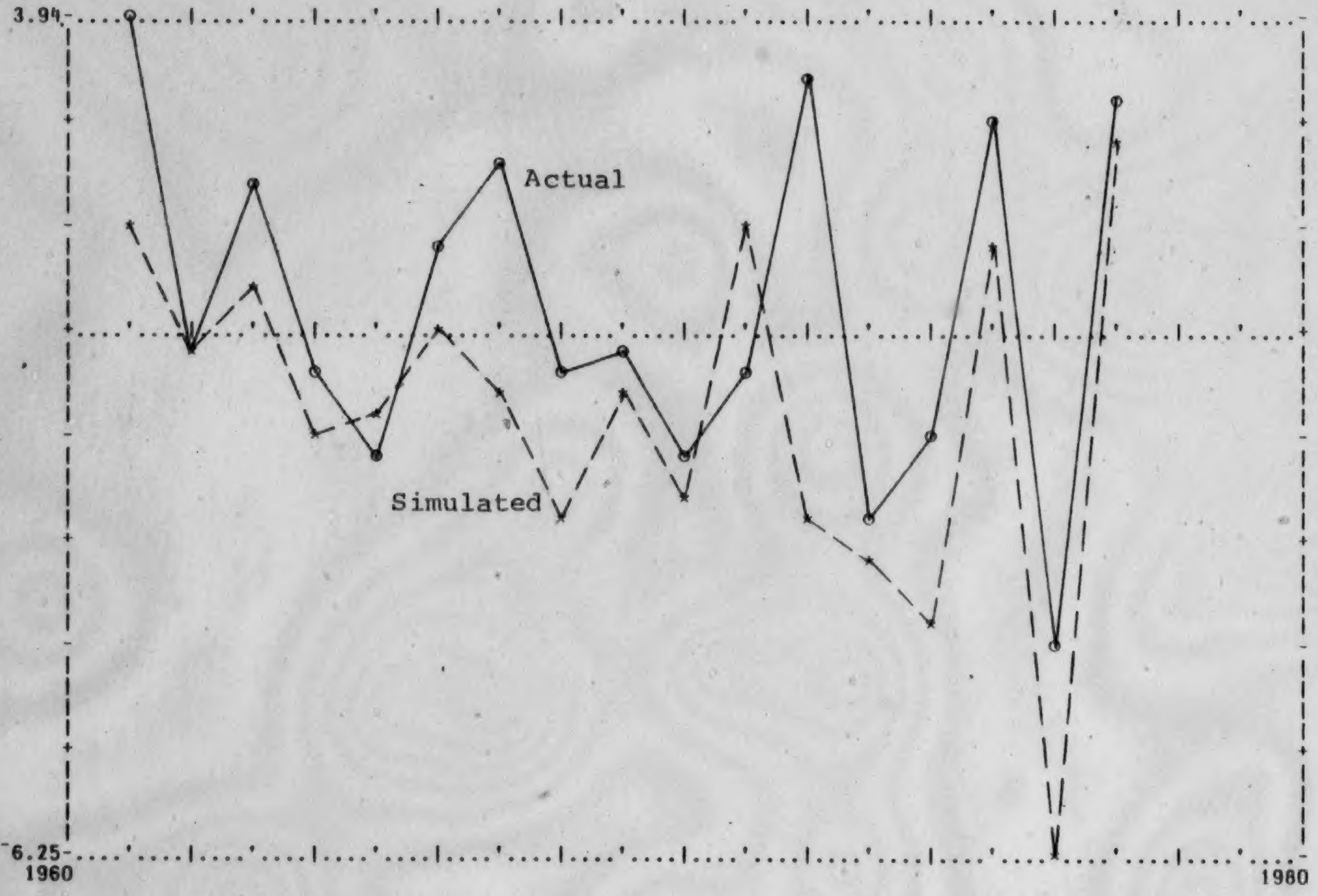


Figure 2

Simulation I: $\dot{P}a/Pa$

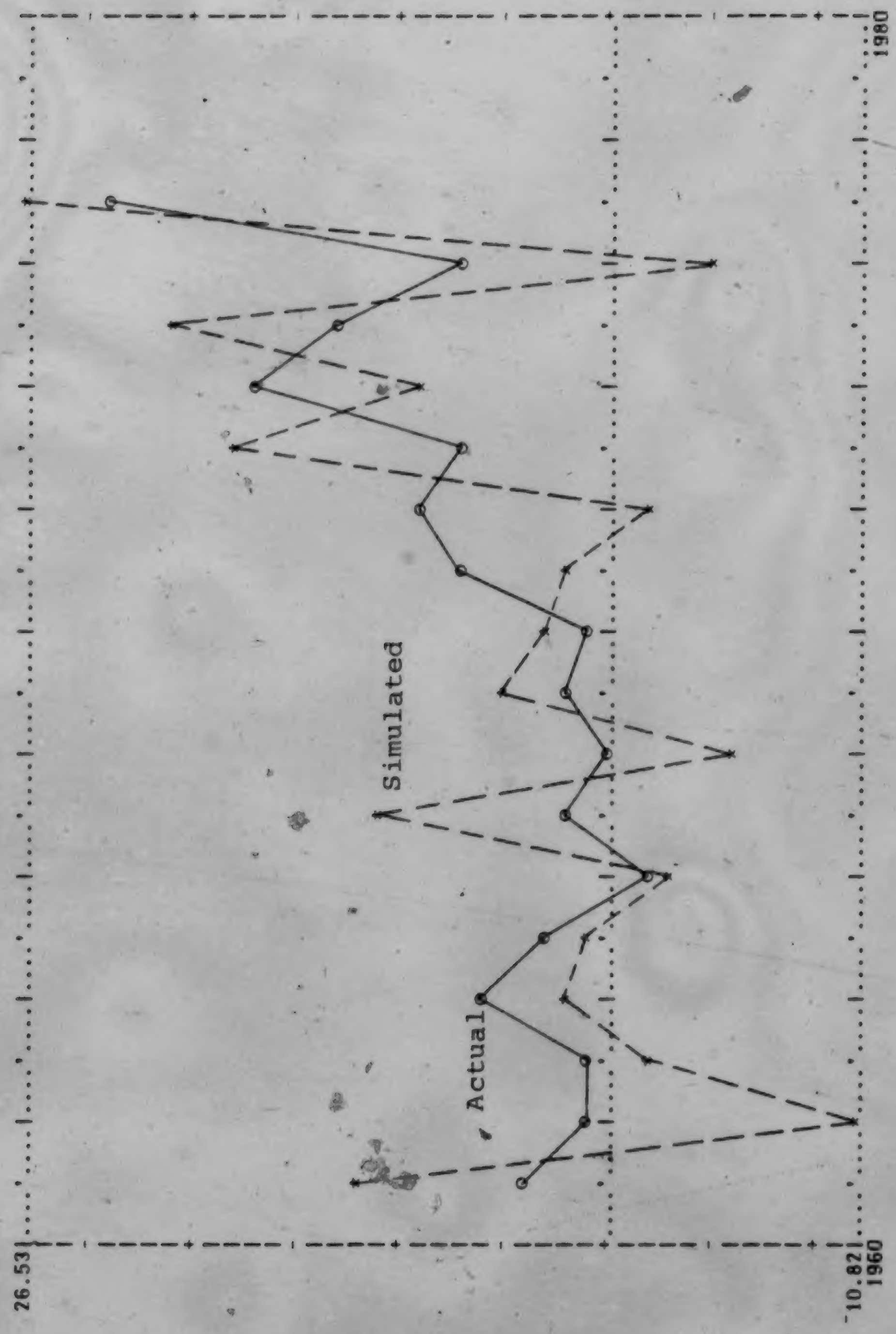


Figure 3

Simulation I: $\dot{P}i/Pi$

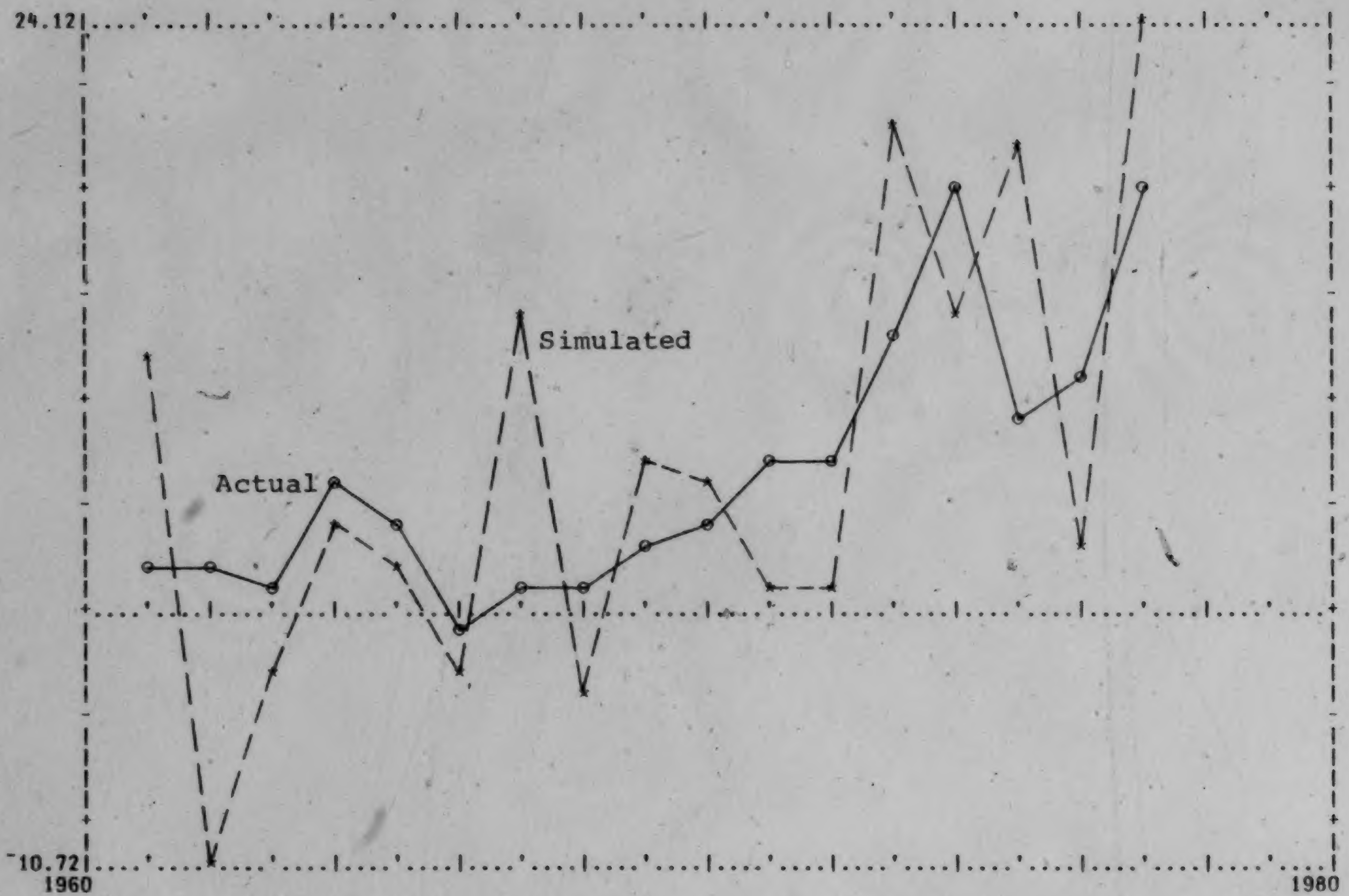


Figure 4

Simulation I: $\dot{P}/P$

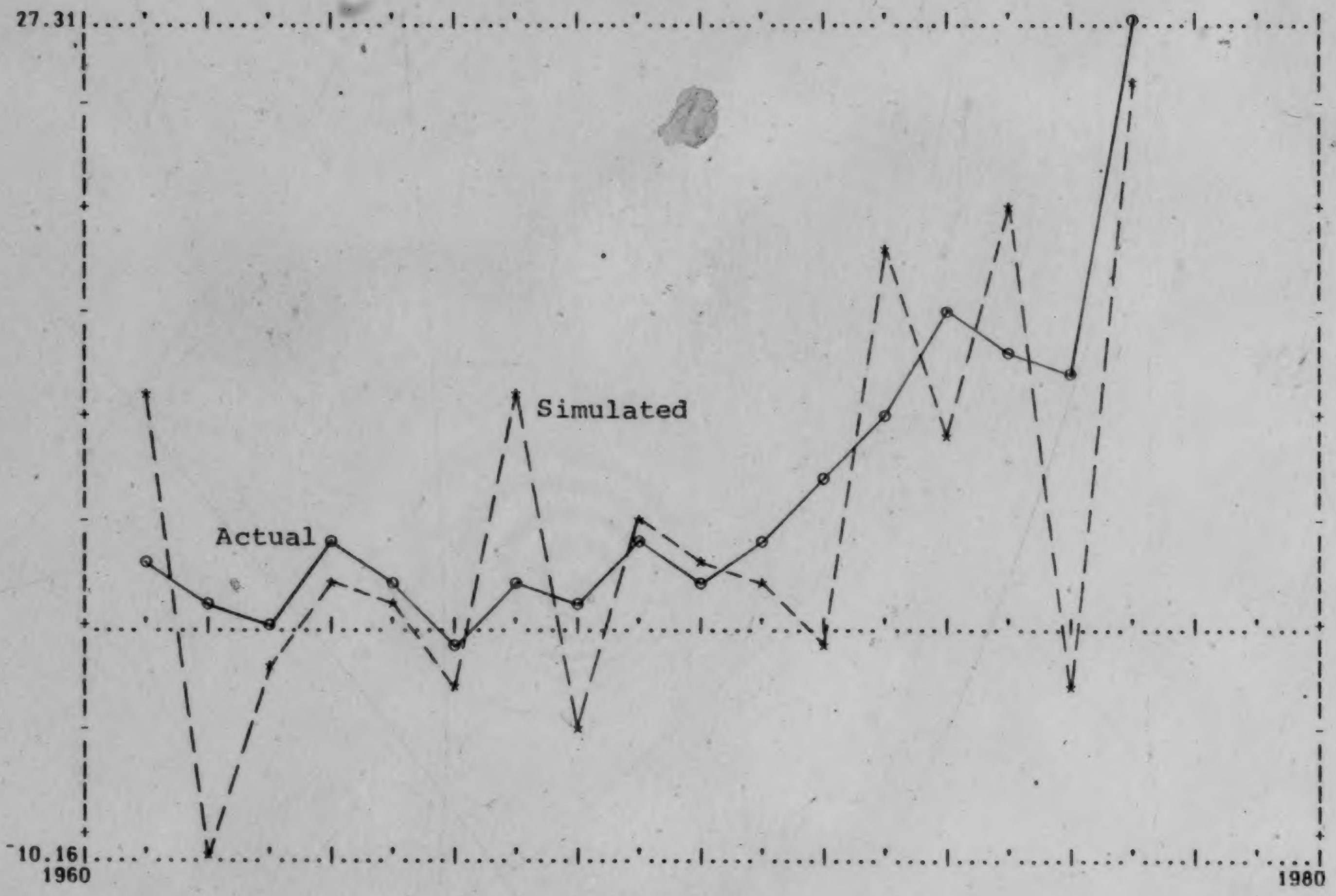


Figure 5

Simulation I: $\dot{W}/W$

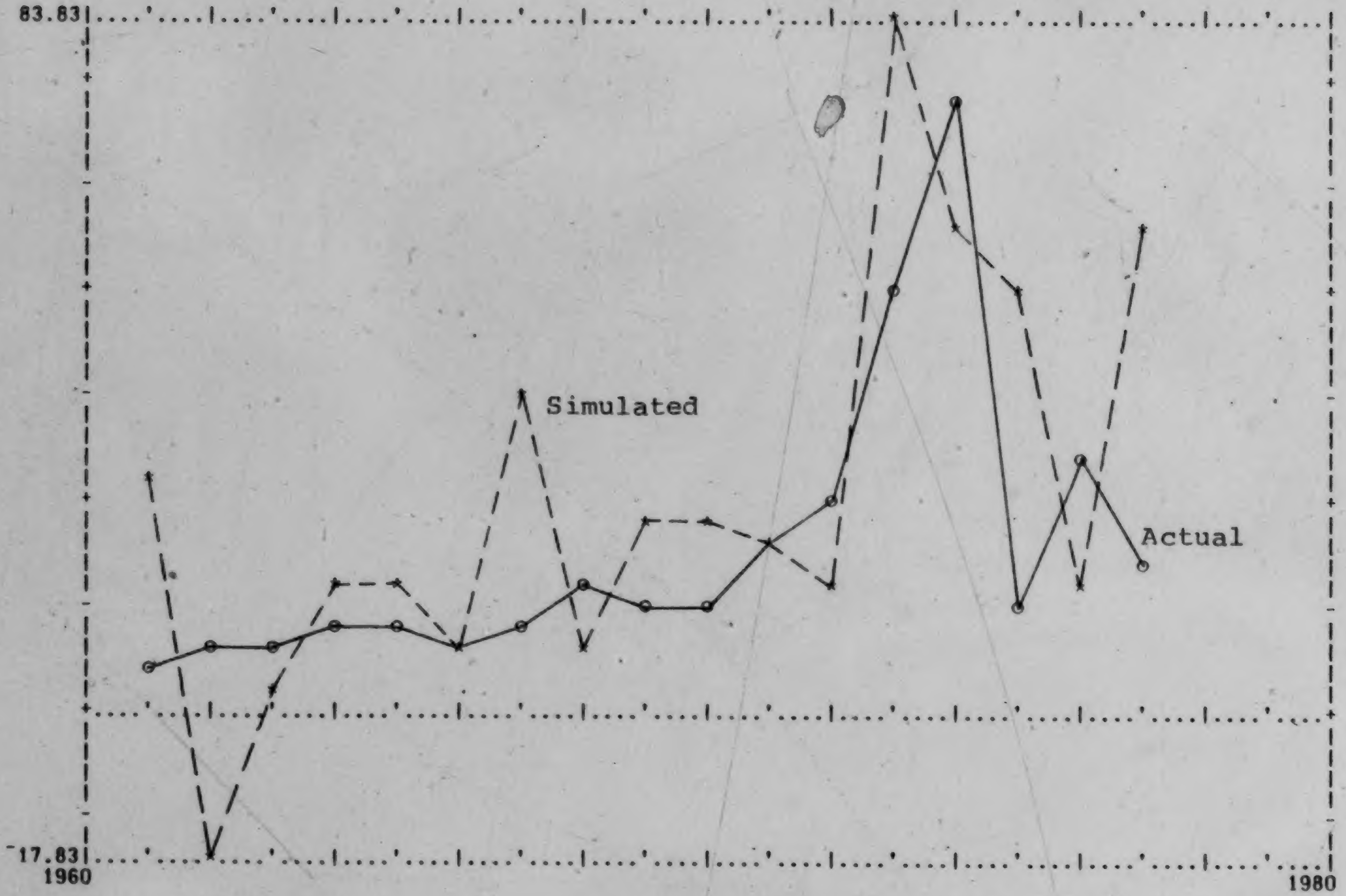


Figure 6

Simulation I: U

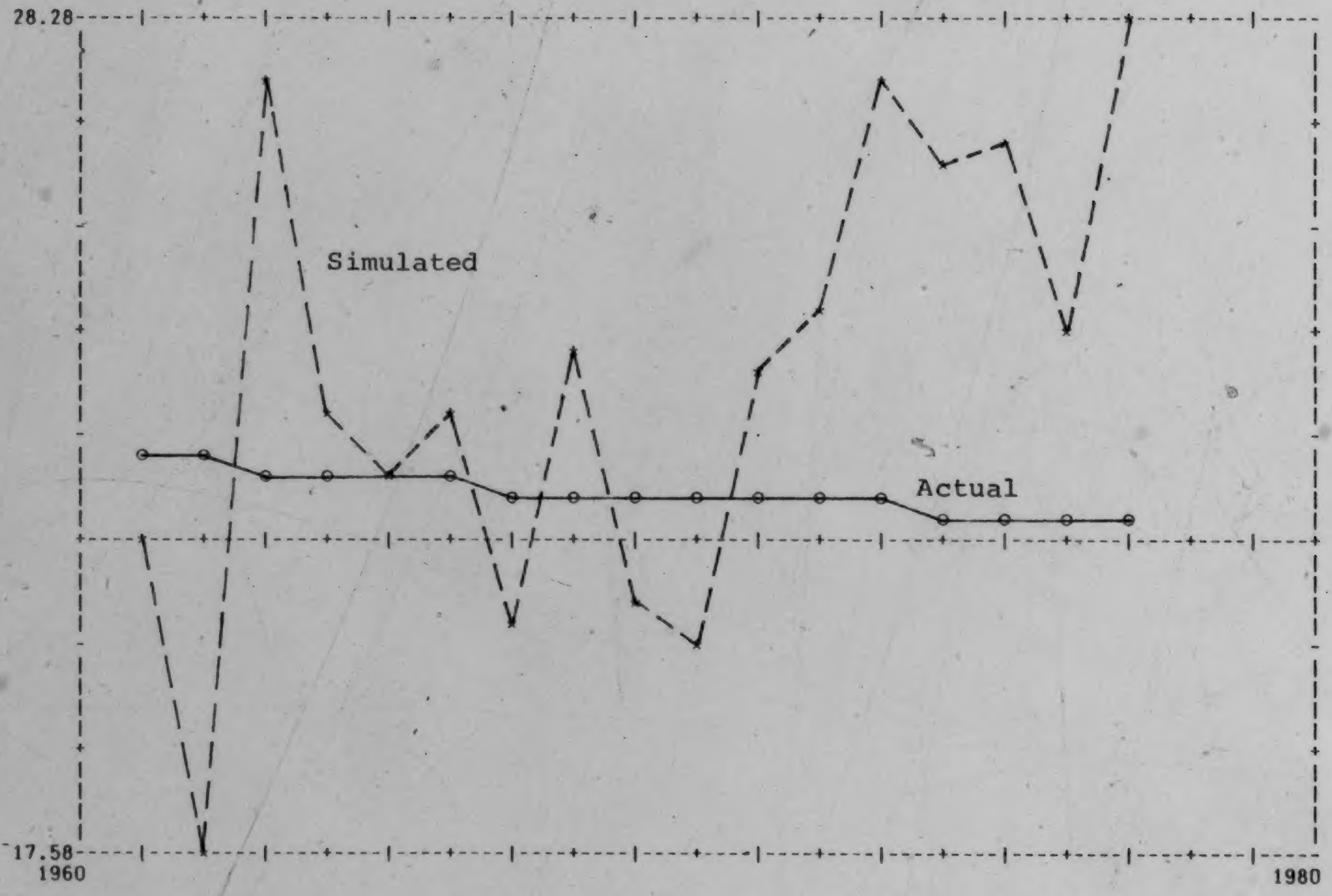


Figure 7

Simulation I: $\dot{Y}/Y$

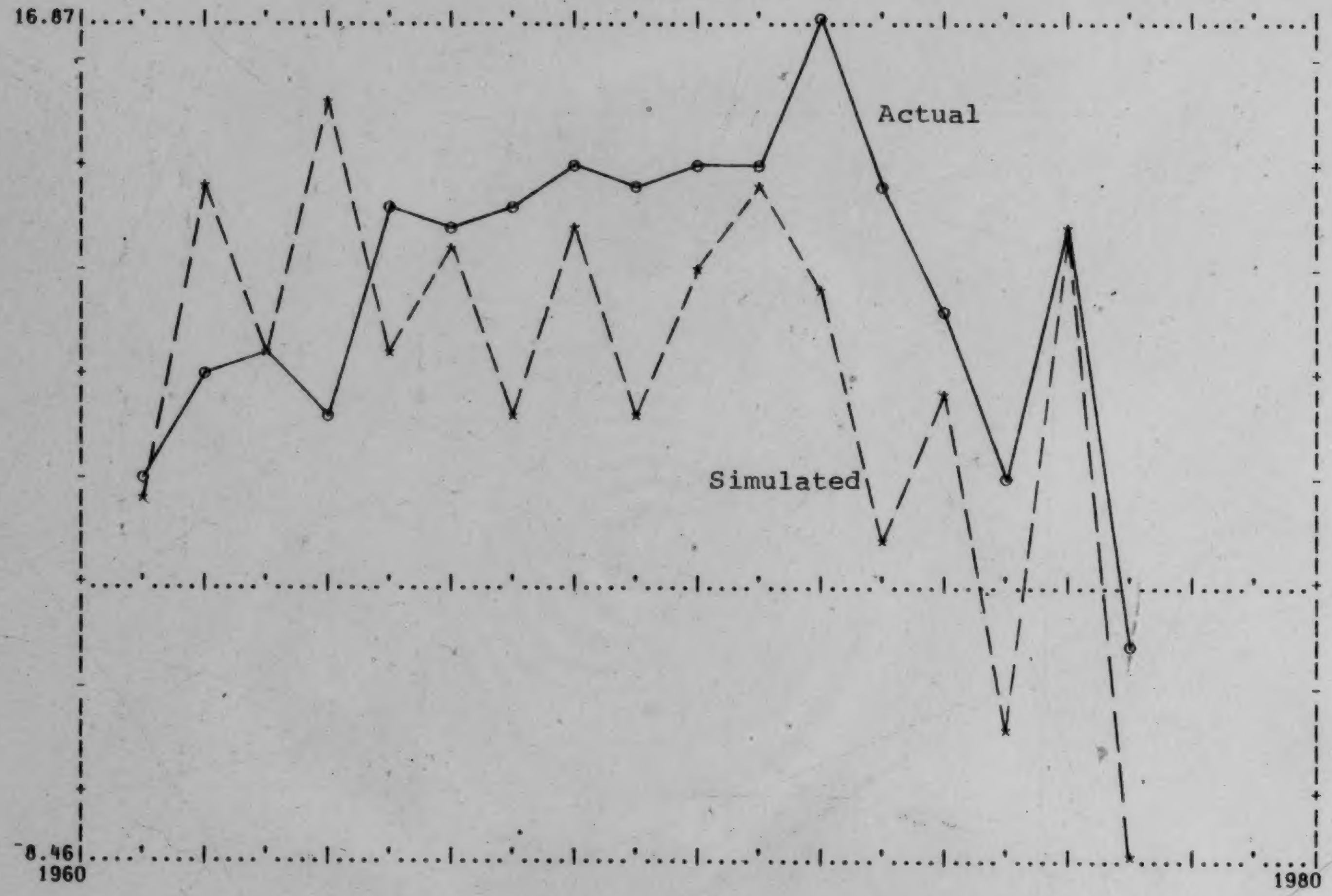


Figure 8

Simulation I: $\dot{M}/M$

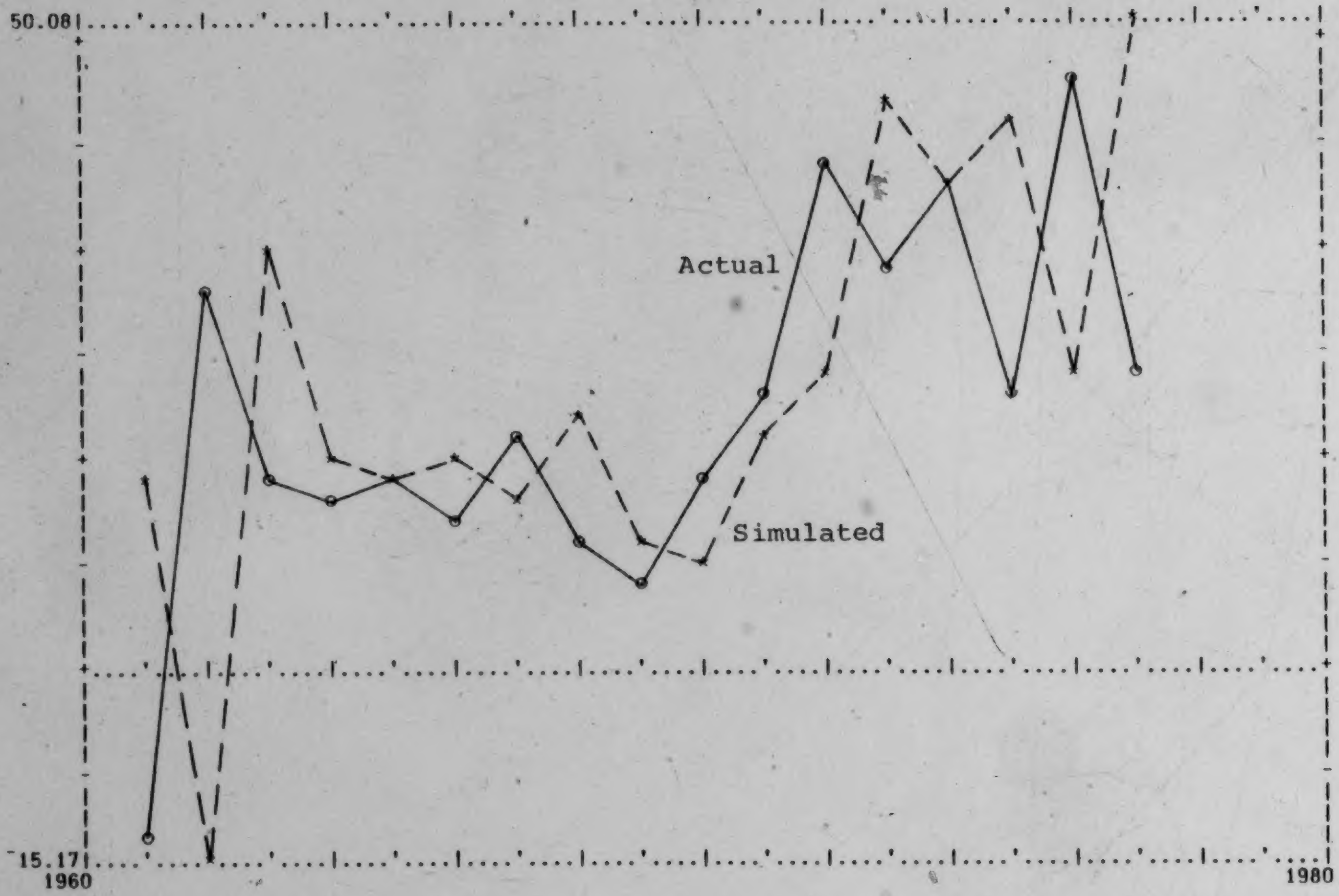


Figure 9

Simulation I: $\dot{D}/D$

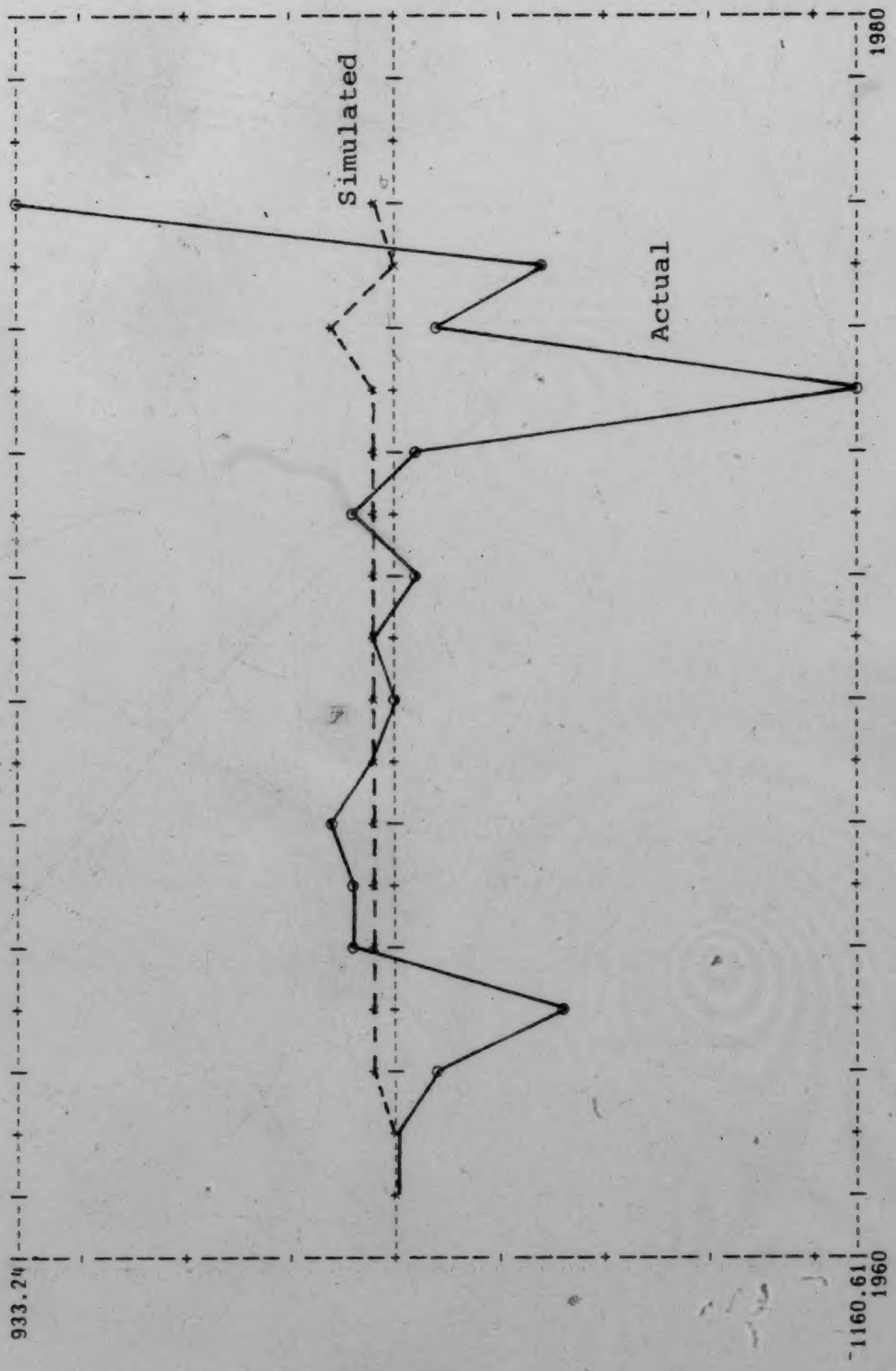


Figure 10

Simulation I: $\dot{G}/G$

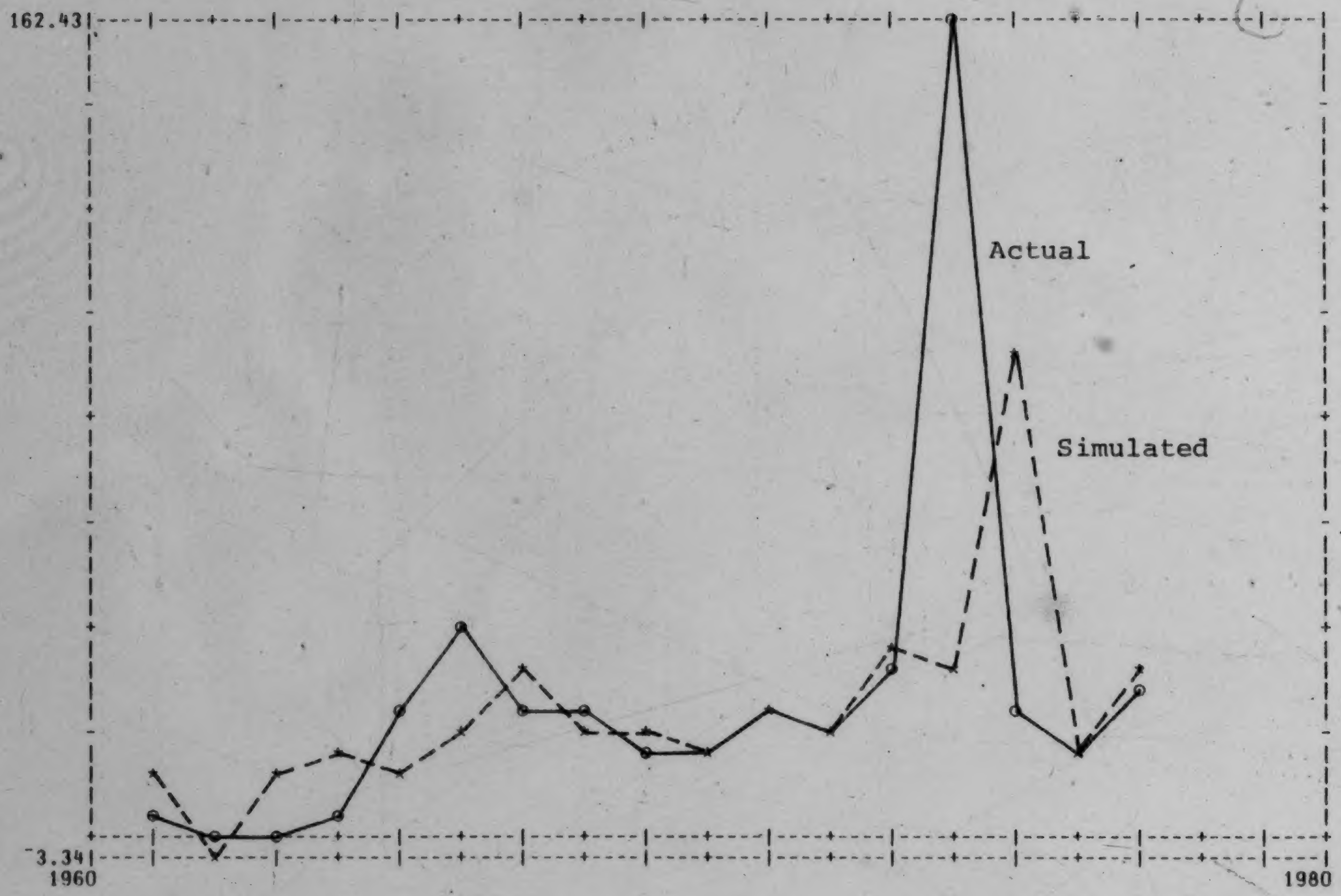


Figure 11

Simulation I: $\dot{R}/R$

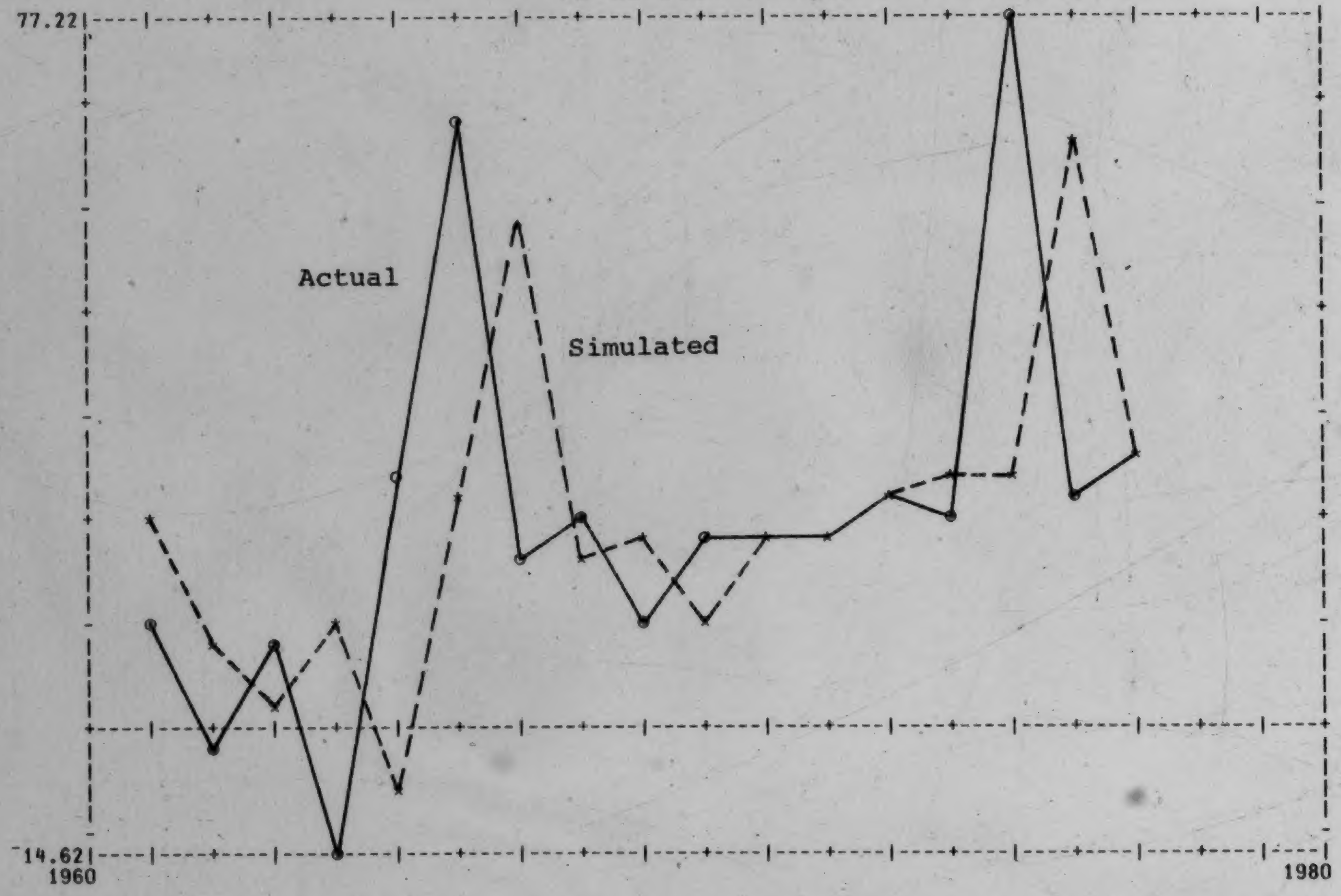


Figure 12

Simulation I: $\dot{B}P/BP$

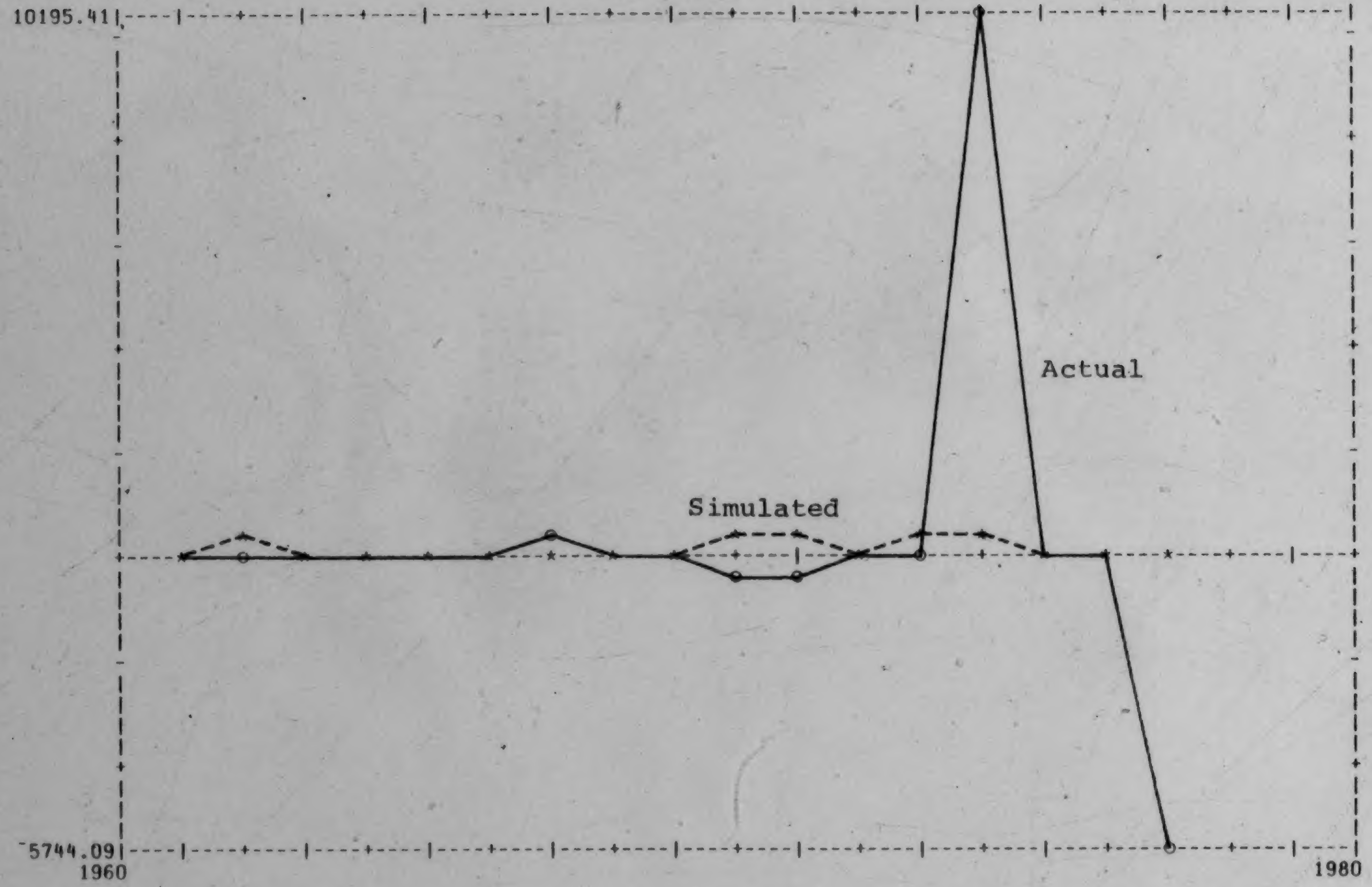
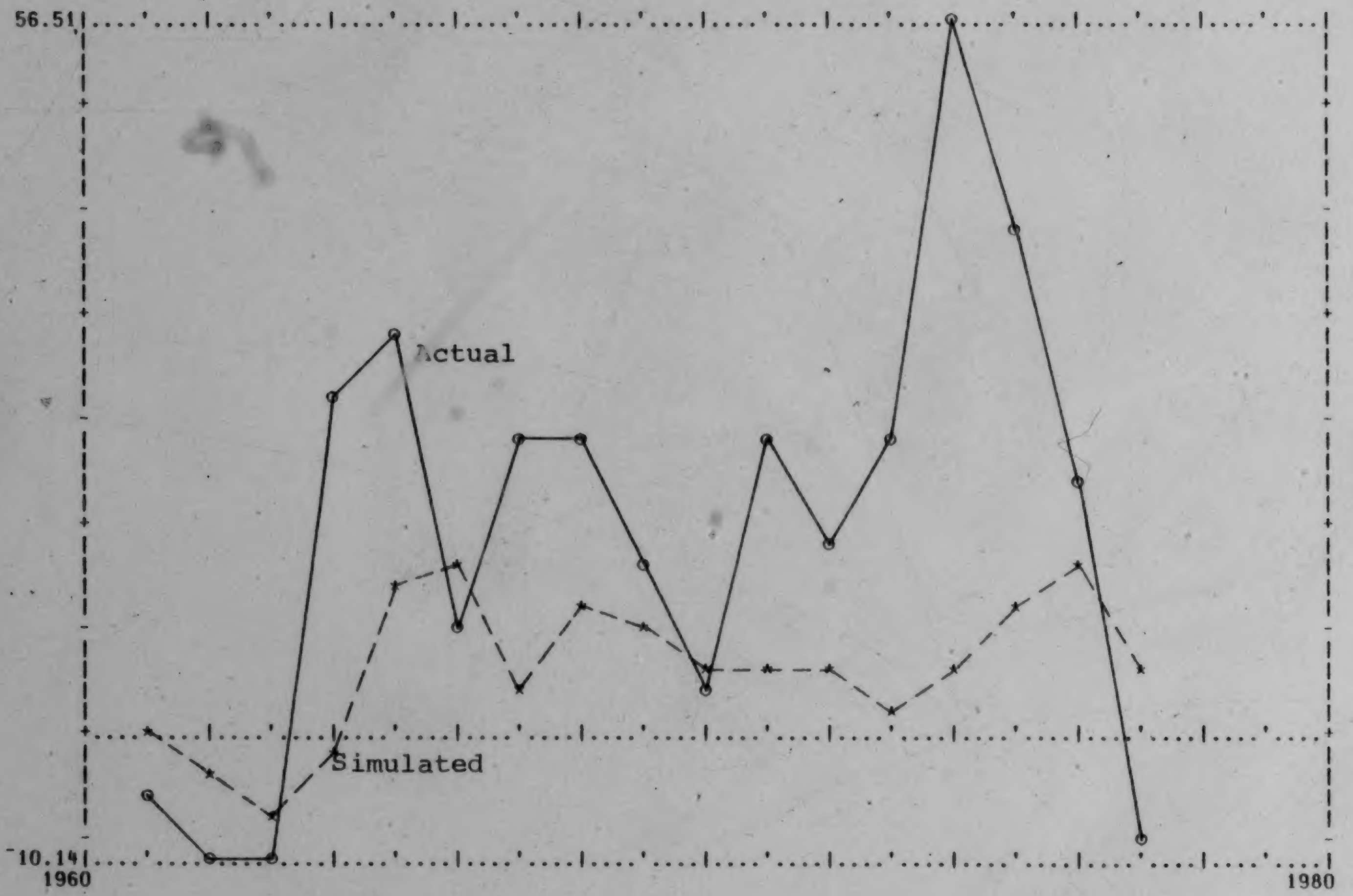


Figure 13

Simulation I: $\dot{Z}/Z$



Figures 1 to 4 show the model traces fairly well the major changes in the rates of change of relative prices of food (F), price of food (Pa), industrial prices (Pi) and the general price level (P), even though they miss some points of minor magnitudes.

Figures 5 and 6 show that the model performs poorly in explaining the rate of change of money wages as well as the unemployment rate. Concerning wage rate, this is to be expected due to the behavior of the government of Iran with respect to wage rate. During the political upheaval of 1961-63 and later 1967-69 as well as post oil price explosion of 1973, the government resorted to unprecedented increase in the wage rates in order to silence the opposition. Concerning the unemployment, there exist hardly any movement in the actual unemployment rate to be picked up by the model.

Figure 7 shows that the model is fairly accurate in tracking the behavior of the real income. Even sharp turning points in this variable, especially in the years towards the end of the period, are traced by the model.

Figures 8, 10, 11, and 13 show that the simulated rate of change of money supply, government expenditures, government revenues and volume of imports tend to lag behind the actual rates. This is to be expected due to the low coefficients of adjustment for these variables in the model. The coefficients of adjustment for these variables estimated by the model are 54 percent, 22 percent, and 56 percent for real government expenditures, government revenues and volume of imports respectively.

The good performance of the model in explaining the balance of payments, Figure 12, may be due to the presence of a large number of exogenous variables contained in that identity.

At this point, it may be desirable to have some quantitative measure of how closely individual variables track their corresponding data series. The measure which is most often used is called *root mean square percent error* (rms % error). The rms % error for the variable 'Y' is defined as follows:[24]

$$\text{rms \% error} = [1/T \sum_{t=1}^{T} (\ (Ys_t - Ya_t)/(Ya_t)\ )^2]^{1/2}$$

where:

Ys = The simulated value of 'Y',

Ya = The actual value of 'Y',

T = The number of periods of simulation.

The 'rms % error' is thus the measure of the deviation of the simulated variable from its actual time path in percentage terms. The smaller the deviation between the simulated and the actual paths the closer the value of 'rms % error' to zero -- the error takes zero value when the two time paths exactly correspond. To test the performance of our model of inflation for Iran, the 'rms % errors' for all endogenous variables in the model are computed and the

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[24] See: R. S. Pindyck and D. L. Rubinfeld, *Econometric Models and Economic Forcasts*, (New York: McGraw Hill, 1981), p. 362.

Table VII-3

Results of Historical Simulation, 1961-1977

Variable	rms % error
F	1.88
Pa	9.70
Pi	16.56
P	5.27
W	1.84
U	11.63
Y	1.18
M	0.89
D	1.38
G	4.60
R	1.18
BP	1.04
Z	0.77

Source: See the text.

results are reported in Table VII-3.

It can be seen from Table VII-3 that a large majority (more than two-thirds) of the 'rms % errors' are below 2 percent; all are below 17 percent. All together, the results point to a close correspondence between the simulated data and their observed counterparts.

D. The Response of the Model to Shocks

In this section the results of three more simulation experiments are presented. The model was simulated with the assumption that the values of three main exogenous variables 'A', '$\dot{P}z/Pz$' and '$Xoil\dot{P}oil/XoilPoil$' namely: the trend rate of growth of output in agricultural sector, rate of change of prices of imports in domestic currency and rate of change of oil exports, respectively, were one percentage point higher throughout the period under study. Simulation I in previous section was the result obtained from solving the model directly, while simulations II, III and IV correspond to the above shocks: 'A', '$\dot{P}z/Pz$' and 'Xoil$\dot{P}$oil/XoilPoil', respectively, to the model.

The simulation results of these shocks are presented in Table VII-4 and Figures AIII-1 - AIII-13 for 'A'; Table VII-5 and Figures AIII-14 - AIII-26 for '$\dot{P}z/Pz$'; and Table VII-6 and Figures AIII-27 - AIII-39 for 'Xoil$\dot{P}$oil/XoilPoil'.

Comparison of Tables VII-2 and VII-4 as well as Figures 1-13 and AIII-1 - AIII-13 show that a higher trend rate of growth of agricultural production, as expected, lowers the rate of change of relative price of food, food prices and hence inflation. This finding is in line with the inadequate supply of agricultural product hypothesis in that with a higher trend rate of growth of food production (A) a lower rate of increase of prices could be achieved. This result supports once again the argument that policies which are directed towards increasing output in the agricultural sector appears to be in the right direction.

Comparison of Tables VII-2 and VII-5 as well as Figures 1-13 and AIII-14 - AIII-26 reveal that a higher rate of change of import prices in domestic currency increases, as expected, the rate of change of wage rates which in turn fuels inflation through higher increases in the rate of change of industrial prices. It also has the same effect through lowering the imports and improving balance of payments surplus.

An increase in the rate of change of oil exports has very small effect on the endogenous variables of the model as expected (see respective elasticities in Table VII-1 above). This result may be justified on the grounds that due to very high actual values of the growth rates in the value of oil exports, our simulation IV could not be expected to produce any significant result. However, changes that have been produced as a result of this dynamic simulation experiment, however negligible, appear to be in the right direction; Tables VII-2 and VII-6 and Figures 1-13 and AIII-26 - AIII-39.

Table VII - 4

Simulation II: Simulated Values of Dependent Variables

	$\frac{\dot{F}}{F}$	$\frac{\dot{Pa}}{Pa}$	$\frac{\dot{Pi}}{PI}$	$\frac{\dot{P}}{P}$	$\frac{\dot{W}}{W}$	U	$\frac{\dot{Y}}{Y}$	$\frac{\dot{M}}{M}$	$\frac{\dot{D}}{D}$	$\frac{\dot{G}}{G}$	$\frac{\dot{R}}{R}$	$\frac{\dot{BP}}{BP}$	$\frac{\dot{Z}}{Z}$
1961	1.09	11.00	9.92	10.18	28.15	0.39	2.77	14.32	10.55	14.20	21.36	- 8.75	- 0.55
1962	-0.45	-11.48	-11.03	-10.72	-18.80	-17.33	12.16	-15.37	- 9.15	- 3.57	7.35	45.79	- 4.22
1963	0.37	- 2.55	- 2.92	- 2.45	1.61	24.77	6.79	32.82	19.45	13.51	1.87	22.54	- 6.82
1964	-1.63	1.33	2.96	1.49	15.31	6.72	14.67	16.62	18.94	16.36	11.30	3.47	- 1.51
1965	-1.27	0.32	1.59	0.49	13.42	3.13	6.92	13.57	20.80	10.96	- 8.35	-24.02	11.26
1966	-0.25	- 3.49	- 3.24	- 3.24	5.97	7.23	10.43	16.63	18.31	20.51	24.83	14.64	13.23
1967	-0.87	10.44	11.31	9.94	36.08	- 4.63	5.23	12.73	23.05	33.76	54.76	12.77	3.70
1968	-2.41	- 6.18	- 3.77	- 5.45	6.04	10.36	10.79	19.49	22.40	20.64	17.19	- 4.51	9.42
1969	-0.87	4.76	5.63	4.61	21.03	- 3.08	5.46	9.75	21.84	21.27	20.15	9.23	7.66
1970	-2.23	2.38	4.61	2.57	20.99	- 5.73	9.46	7.75	17.84	15.68	11.45	39.63	4.14
1971	0.95	1.42	0.47	1.19	18.93	8.62	12.36	17.15	25.21	23.54	20.27	65.43	4.51
1972	-2.40	- 1.98	0.42	- 1.50	14.24	12.96	9.01	22.88	24.31	22.51	18.98	-18.56	4.86
1973	-2.97	16.70	19.67	16.14	82.86	24.88	1.51	43.37	41.54	35.85	24.69	62.99	1.50
1974	-3.67	7.87	11.54	7.95	58.18	20.68	5.98	36.74	37.45	33.60	26.05	324.63	5.38
1975	0.79	19.76	18.97	18.46	50.63	21.83	- 3.58	42.14	130.11	95.24	26.87	-28.05	10.28
1976	-6.60	- 4.66	1.94	- 3.39	13.41	11.85	10.59	22.16	- 6.29	17.51	64.16	8.33	13.92
1977	2.06	25.87	23.80	24.01	56.70	28.53	- 8.04	50.34	39.08	35.62	28.83	-44.92	4.29

Source: See the text.

Table VII - 5

Simulation III: Simulated Values of Dependent Variables

	$\frac{\dot{F}}{F}$	$\frac{\dot{Pa}}{Pa}$	$\frac{\dot{Pi}}{Pi}$	$\frac{\dot{P}}{P}$	$\frac{\dot{W}}{W}$	U	$\frac{\dot{Y}}{Y}$	$\frac{\dot{M}}{M}$	$\frac{\dot{D}}{D}$	$\frac{\dot{G}}{G}$	$\frac{\dot{R}}{R}$	$\frac{\dot{BP}}{BP}$	$\frac{\dot{Z}}{Z}$
1961	1.42	12.44	11.03	11.49	30.65	- 0.18	1.96	14.32	11.27	14.73	21.50	- 8.94	- 1.09
1962	-0.12	-10.04	- 9.92	- 9.42	-16.30	-17.90	11.35	-15.36	- 8.42	- 3.05	7.50	45.60	- 4.77
1963	0.70	- 1.10	- 1.81	- 1.14	4.11	24.21	5.98	32.82	20.18	14.04	2.01	22.35	- 7.36
1964	-1.30	2.77	4.07	2.80	17.81	6.15	13.86	16.62	19.67	16.89	11.45	3.28	- 2.05
1965	-0.94	1.76	2.70	1.79	15.92	2.56	6.11	13.58	21.52	11.48	- 8.20	-24.20	10.71
1966	0.08	- 2.05	- 2.13	- 1.94	8.47	6.66	9.62	16.63	19.03	21.04	24.97	14.45	12.69
1967	-0.54	11.88	12.42	11.25	38.59	- 5.20	4.43	12.74	23.77	34.29	54.91	12.58	3.16
1968	-2.08	- 4.74	- 2.66	- 4.14	8.55	9.79	9.98	19.50	23.12	21.17	17.34	- 4.70	8.87
1969	-0.54	6.20	6.74	5.91	23.53	- 3.65	4.65	9.76	22.56	21.80	20.30	9.05	7.11
1970	-1.90	3.82	5.73	3.88	23.49	- 6.30	8.65	7.76	18.56	16.21	11.60	39.44	3.59
1971	1.28	2.86	1.58	2.49	21.44	8.05	11.56	17.16	25.93	24.07	20.42	65.24	3.97
1972	-2.07	- 0.54	1.53	- 0.20	16.74	12.39	8.20	22.88	25.04	23.04	19.13	-18.75	4.31
1973	-2.64	18.14	20.78	17.45	85.36	24.31	0.70	43.37	42.26	36.38	24.84	62.80	0.95
1974	-3.34	9.31	12.65	9.25	60.69	20.11	5.17	36.75	38.17	34.13	26.20	324.44	4.84
1975	1.12	21.20	20.08	19.76	53.13	21.26	- 4.38	42.14	130.83	95.77	27.02	-28.24	9.69
1976	-6.27	- 3.22	3.05	- 2.08	15.92	11.28	- 9.79	22.17	- 5.56	18.04	64.31	8.14	13.37
1977	2.39	27.31	24.92	25.31	59.20	27.96	- 8.85	50.34	39.80	36.15	28.98	-45.11	3.74

Source: See the text.

Table VII - 6

Simulation IV: Simulated Values of Dependent Variables

	$\frac{\dot{F}}{F}$	$\frac{\dot{Pa}}{Pa}$	$\frac{\dot{Pi}}{Pi}$	$\frac{\dot{P}}{P}$	$\frac{\dot{W}}{W}$	U	$\frac{\dot{Y}}{Y}$	$\frac{\dot{M}}{M}$	$\frac{\dot{D}}{D}$	$\frac{\dot{G}}{G}$	$\frac{\dot{R}}{R}$	$\frac{\dot{BP}}{BP}$	$\frac{\dot{Z}}{Z}$
1961	1.43	11.65	10.22	10.74	29.10	0.15	2.43	14.33	10.86	14.43	21.42	- 8.11	- 0.53
1962	-0.10	-10.83	-10.73	-10.17	-17.86	-17.57	11.82	-15.21	- 8.83	- 3.34	7.42	46.44	- 4.21
1963	0.72	- 1.90	- 2.61	- 1.89	2.56	24.53	6.45	32.83	19.77	13.75	1.93	23.18	- 6.80
1964	-1.28	1.98	3.26	2.05	16.25	6.48	14.33	16.63	19.26	16.60	11.37	4.12	- 1.49
1965	-0.92	0.97	1.89	1.05	14.37	2.89	6.58	13.58	21.12	11.19	- 8.28	-23.37	11.27
1966	0.10	- 2.84	- 2.94	- 2.68	6.91	6.99	10.09	16.64	18.63	20.74	24.89	15.28	13.25
1967	-0.53	11.09	11.61	10.50	37.03	- 4.87	4.89	12.74	23.37	33.99	54.83	13.41	3.72
1968	-2.06	- 5.53	- 3.47	- 4.89	6.99	10.12	10.45	19.50	22.72	20.87	17.26	- 3.86	9.43
1969	-0.52	5.41	5.94	5.17	21.98	- 3.32	5.12	9.77	22.16	21.50	20.22	9.88	7.67
1970	-1.89	3.03	4.92	3.13	21.93	- 5.97	9.12	7.76	18.16	15.92	11.52	40.28	4.15
1971	1.30	2.07	0.77	1.75	19.88	8.38	12.02	17.16	25.53	23.77	20.33	66.08	4.53
1972	-2.05	- 1.33	0.72	- 0.94	15.18	12.72	8.67	22.89	24.63	22.75	19.05	-17.92	4.88
1973	-2.63	17.35	19.98	16.70	83.81	24.64	1.17	43.38	41.86	36.08	24.76	63.64	1.51
1974	-3.33	8.52	11.84	8.51	59.13	20.44	5.64	36.75	37.77	33.83	26.11	325.28	5.40
1975	1.14	20.41	19.27	19.02	51.58	21.59	- 3.92	42.15	130.43	95.47	26.94	-27.40	10.25
1976	-6.25	- 4.01	2.24	- 2.83	14.36	11.61	10.25	22.17	- 5.97	17.74	64.23	8.98	13.93
1977	2.41	26.52	24.11	24.57	57.64	28.29	- 8.38	50.16	39.40	35.85	28.89	-44.27	4.31

Source: See the text.

VIII. CONCLUSION

A. Summary

The purpose of this study has been to assess the causes of inflation in Iran over the period 1959-1977.

Inflation was defined to be a situation in which there was a persistent upward movement in the general level of prices, or in which there would be such a persistent upward movement but for the presence of direct controls over the prices. The problems involved in the measurement of inflation were investigated and the price index to represent inflation was chosen to be the consumer price index.

A review of literature on inflation in less developed countries and a critical examination of main characteristics of different views on inflation in these countries was carried out in Chapter III. It was pointed out in that chapter that the debate over the causes and consequences of inflation in less developed countries has largely been between two groups loosely labelled structuralists and monetarists. Each of these groups represent a certain type of approach to the problem of inflation in particular, and to the problem of economic development in general.

Structuralists argue that inflation is inevitable in an economy which is attempting to grow rapidly in the presence of structural bottlenecks. They argue that inflation in less developed countries usually accompanies the transition of these economies from an outward-oriented export-based economy to an inward-oriented domestic-market based economy in which the import substituting industrialization plays a key role. According to structuralists, fundamental changes in the socio-economic structure that are required by such economic development can not be brought about by the price mechanism operating within very imperfect market structures characterized by limited resource mobility, and thus shortages and disequilibria appear. The main body of structuralist literature is concerned with the identification and analysis of three key bottlenecks namely the inelastic supply of agricultural products, the foreign exchange constraint and the government budget constraint.

The monetarist position on the causes of inflation in less developed countries states in a familiar way that excess demand is responsible for inflation. Therefore, they believe that increases in money income occur in response to increases in aggregate demand. Inflation is the result of continued expansion of aggregate demand after real income approaches the capacity or supply constraints of the economy. According to monetarists, inflation is generated by unjustified expansion both in government deficits, which is financed mostly by increases in the money supply, and in central bank loans to the public and to commercial banks. Due to the weakness of government bond markets, little expansion in aggregate demand occurs without concomitant growth in the money supply. Therefore, increases in the money supply accompany expansionary fiscal policy as well as expansionary monetary policy. Monetarists do not deny the existence of constraints but argue that they are not structural and rather, they result from the price and exchange rate distortions which are generated by inflation itself and the attempt on the part of the government to reduce the rate of inflation.

A concise review of the structure of the Iranian economy, in Chapter IV, presented a general introduction to the economic conditions and policies implemented over the period of the study. In brief, it was shown that the Iranian economy has exemplified to an extreme degree the dual process of growth and rapid structural change. The major factor underlying the country's growth performance seems to have been the increase in the volume and the value of oil exports. Strong inflationary pressures that appeared in the late 1960's were intensified by mid 1970's. It was also seen that, in the presence of an inefficient tax policy, the monetary policy has been the principal stabilization tool used in the country. With the higher oil revenues after 1973, the price situation considerably deteriorated which reflected the growing inefficiency of monetary policy in curbing excess demand inflationary pressures in the absence of cooperation from fiscal authorities.

A broadly based model of inflation, specific to Iran, was developed in Chapter V. The basic model developed consists of eleven equations and three identities which simultaneously determine the rates of change of the relative price of food, agricultural prices, industrial prices, wage rates, general price level; real income, expected rate of inflation, money supply, government budget deficits, government expenditures, government revenues, imports, balance of payments, and the unemployment rate.

This model could be thought of as an integrated model which includes both the structuralist and the monetarist explanations of inflation in less developed countries. The model was then estimated and analyzed in Chapters VI and VII, using annual data for Iran for the period 1959-1977.

The structuralist position adopted in the first equation of our model required the analysis of adequacy of agricultural production in Iran. This analysis centered on the computation of the 'required' rates of growth of food production for price stability based on presumed as well as estimated income elasticity of demand for food. These computed required growth rates were then compared with the growth rates in indices of total food production and total agricultural production as well as the annual growth rates of real value added in agricultural sector. It was found that, except for the years 1961, 1963 and 1970 all the required growth rates for price stability outpaced the different observed growth rates. In addition, a comparison of the estimated required rates of growth of food production for price stability with the actual growth rate of food production adjusted for any price effect on the production of agricultural products revealed that the former outpaced the latter for the entire period of the study except for the year 1963. This result thus supported the original hypothesis of this study which stated that inadequacy of food production caused an increase in the rate of change of relative price of food, which in its turn led to higher rate of inflation.

The empirical results of the simultaneous equations model suggested that both structuralist and monetarist factors were responsible for the inflationary pressures in Iran. The structural part of the model was supported by the finding of significant coefficients with expected signs in the relative price of food, industrial prices and wage equations. In addition, the finding of significant coefficients with anticipated signs in the demand for money equation, government expenditures and revenues equations as well as imports equation were consistent with the monetarist argument in that excess demand was also responsible for inflation in an open economy like that of Iran.

In regard to industrial prices, it was found that its main determinants in Iran were wages, output per-person, import prices and capacity utilization rate. Industrial prices vary directly with wages and import prices and were inversely related to the output per-person as well as capacity utilization rate.

The main determinants of wages in Iran were found to be unemployment rate, level of prices, import prices and demand shift hypothesis. Examination of the wage equation showed that the predictions of the wage relationship model are supported by the Iranian data.

In the price equation, food prices contributed substantially to the consumer prices, a result which supports the structuralist hypothesis. Industrial prices were also found to have an impact on the consumer price index, but not as strong as food prices.

The second part of the model examined the nature of propagation mechanism in the process of inflation, that is the relationship between increases in the money supply and inflation in Iran. If specific social groups or classes are unable to regain their previous position relative to other groups after an inflationary increase in prices has led to a fall in their real standard of living, relative price changes will not lead to an inflationary spiral. They will lead to a redistribution of income, and the relationship between inflation and income distribution is of crucial importance. In particular, the distribution of economic, and hence political, power determines the range of policy options that any particular government is likely to pursue and the process of inflation itself alters the economic and political power structure of the inflating economy.

In the study, it was shown that the growth in the supply of money and inflation are linked in a two-way relationship in Iran. The model was designed to explicitly introduce the link in the form of reactions of the government fiscal deficit and balance of payments surplus to inflation. The basic hypothesis was that an increase in the rate of inflation increases the real value of the fiscal deficit, owing to the fact that expenditures keep pace with inflation while nominal revenues tend to lag behind. This hypothesis was empirically verified. The financing of this deficit as well as balance of payments surplus increases the supply of money, thus generating further inflation. In this framework, we observed that increases in the supply of money both caused inflation and, at the same time, were positively affected by it.

Our major results can be summarized as follows: that food prices and industrial prices as well as import prices have considerable impact on inflation in Iran; that there exist a wage-price relationship in Iran; that wages, as a cost variable, are significant; and that there exist a two-way causality between money and prices in Iran. These results clearly favour the structuralist position as well as monetarist position since money, as it was expected, is in the picture. The implications of all these is that monetary policy alone may not be effective in controlling inflation in general. The existence of other strong non-monetary forces can sustain the inflationary pressures and weaken the influence of monetary policy. That is, since the relative price of food in Iran has increased over time, this suggests that the rate of change in the relative price of food has been positive more often than negative and, therefore, that the inflation rate in the Iranian economy has been higher than would have been the case if purely monetarist variables were at work. These results imply that, in any attempt to control inflation, policies that improve agricultural productivity and those that discourage monopoly power along with the traditional policies of controlling excess aggregate demand will aid in limiting the inflationary process in Iran.

To study the direct as well as indirect impact of each predetermined variable on the endogenous variables, the reduced form of the estimated version of the model was derived. The elasticity multiplier analysis of our model revealed that the responsiveness of almost all endogenous variables to changes in predetermined variables were either enhanced or remained constant. These findings strenghtend our earlier suggestions that policies which are aimed at increasing output in the agricultural sector, raising output per-person in the industrial sector, reducing the growth rate of population as well as those directed towards controlling the growth of money supply appear to be in the right direction.

In order to examine how well the model developed in Chapter V of this study traces the actual movements in the Iranian economy, a dynamic simulation exercise -- an analysis in which the values of the lagged endogenous variables were themselves generated by the simulation process -- of the reduced form of the model was carried out. The results pointed to a close correspondence between the dynamically simulated data and their observed counterparts.

Finally, the response of the model to three different exogenous shocks was studied. The model was simulated with the assumption that the values of three main exogenous variables namely: the trend rate of growth of output in agricultural sector, the rate of change of import prices in domestic currency, and the rate of change of oil exports were one percentage point higher throughout the period under study. The results supported the basic hypotheses of our model. A higher trend growth rate of agricultural production lowered the rate of change of relative price of food, food prices and reduced the rate of inflation. A higher rate of change of import prices increased the rate of change of wage rates which along with higher increases in the rate of change of industrial prices fueled inflation. Lastly, the increase in the rate of change of oil exports had small effect on the endougenous variables of the model which might be attributed to the low respective elasticities.

B. Limitations of the Study

The main shortcoming of this study is that of data coverage and accuracy of data. Inadequacy of data is due to restricted coverage and to method used in compiling the data. For example, the product of non-monetary sector in Iran, is simply estimated. As new data become available, the model can be improved and updated.

Lack of data on wage rates and unemployment rates created serious problems. An index of compensation of employees out of GDP was used as a proxy for the wage variable in the industrial sector. This choice, however, overestimated the wage rate in that it included salaries of both public and private sector employees as well as wages. With regard to unemployment rate, the only data available were those for employment levels for the period 1962-1975. Unemployment figures were estimated on the basis of these figures and the figures for the remaining periods were generated.

The choice of the consumer price index as a measure of inflation is an imperfect one. The consumption basket used reflects the purchasing patterns of only a particular income segment and employs data relating only to the capital city. A further difficulty is introduced by the practice, in Iran, of subsidizing the purchase of commodities that play a key role in the consumer price index.

Finally, a more disaggregated measure of variables -- such as GDP versus non-oil GDP, developmental versus non-developmental government expenditures -- could prove to be more useful. Specially, the ability of the model in explaining inflation in Iran could have been enhanced by decomposing total government expenditures into avoidable and unavoidable components. However, our choice was affected by the absence of available data.

C. Policy Implications

This study supported the hypothesis that a two-way relationship exists between inflation and liquidity expansion and to a lesser extent between inflation and domestic budget balance in Iran. In addition we found that lags in the adjustment of government expenditures were not as long as the corresponding revenue lags, which lead to higher deficits in more inflationary periods.

Four major categories of fiscal policy were identified in Iran over the period of study in Chapter IV. These included the introduction of direct subsidy payments on a wide range of goods and services; the introduction of indirect subsidies through the pricing policies of public enterprises such as electricity, water and petroleum products; the reduction and in some cases elimination of several categories of domestic taxation particularly import duties and taxes on goods and services; and the semi-abolition of user charges for the state-supplied services in health, education and other areas.

These instruments were chosen to reduce inflation generally, apparently by means of eliminating rising price expectations, as well as to offset the impact of inflation on particular groups. Another important objective of these policies was to provide rapid improvements in standard of living of the population. The actual inflation experience in Iran suggested that such policies were unsuccessful. This may support the view that any decline in price expectations would probably be short-lived if it were produced by policies involving a direct increase in domestic budget deficit and domestic liquidity. All four elements of fiscal policy outlined above implied both of these developments. Pursuing these policies meant that the government attacked the symptoms of inflation by means that further intensified the causes of inflation. As a result, the government of Iran turned to price controls, an instrument that apparently offers a reduction in expectations without, at the same time, producing more expansionary fiscal and monetary policies.

Price controls may appear to have played a role in holding down the rate of increase in 'official' price indices, but it is highly questionable whether they were able to reduce the underlying inflationary pressures.

In this respect, the basic policy suggestions that emerge are first that, the tendency of government budgetary positions to be automatically destabilizing in the Iranian economy underscores the need for an actively anti-inflationary fiscal policy rather than a passive fiscal policy which in times of inflation may be hazardous. In addition, priority should be given to reshape the revenue system in order to relieve the revenue lags involved which were discussed above.

With respect to monetary policy, the Iranian economy is characterized by a high degree of openness, with the exchange rate arrangements more akin to fixed than to freely fluctuating rates. The combination of these factors limited the scope for an independent monetary policy, since an open economy with a fixed exchange rate can not have an inflation rate consistently different from the world inflation rate. It is necessary to stress that this does not imply that Iran should adopt floating exchange rate in order to secure greater freedom in monetary policy.

As we saw in Chapters IV and V, certain institutional constraints on the flexibility of specific monetary instruments suggested that fine tuning through frequent policy changes was unlikely to be successful in Iran. Given the absence of well-developed money and capital markets, it is difficult to conduct open market operations. Changes in reserve requirements, as it was frequently practiced in Iran, are recognized to be too blunt an instrument and one that could have adverse effects on the long-term development of the banking system. In addition, the regulation and rigidity of interest rates meant that variations in them were often not available as signals of changing credit conditions in Iran. Therefore, the target-oriented monetary policies, as opposed to policies aimed at fine tuning the economy, could be better suited to the circumstances of Iran.

As was shown, inflation in Iran originated partially in sectoral bottlenecks and imbalances in the economy. The reduction of inflation, therefore, will necessitate the adoption of policies aimed at altering the fundamental structure of the economy.

Concerning the agricultural sector, it was demonstrated that, in terms of its share of total output and employment this indeed has been the declining sector of the Iranian economy. During the period of 1959-1977, agricultural production grew at an annual average rate of 2 percent and showed a negative growth rate of over 3 percent between 1973 and 1977 (see Table IV-5). This performance lagged considerably behind the rest of the economy and as we saw, lagging agricultural production was an important source of inflationary pressure. Therefore, well defined policies to bridge the gap between the supply of and demand for agricultural commodities is necessary to relieve these pressures. Given the socio-political climate of the country and its past record with respect to land reform and other policies in this sector, it is difficult to suggest or to guess as to what specific policies are viable at present.

With regard to the industrial sector, the main development strategy that was pursued in Iran was that of import substituting industrialization. As a result of this development, the import of finished consumer goods was reduced but the commodity composition of imports changed towards raw materials, semi-finished inputs and capital goods. That is, non-essential consumer goods imports were converted into essential raw material and intermediate and capital goods imports, needed to maintain domestic production and employment. In this way, import substituting industrialization aggravated the inflationary tendencies that existed in the country and increased the vulnerability of the economy to imported inflation by changing the structure of imports. In this respect, a development strategy must aim at structural changes permitting self-sustaining growth and should include, among other things, measures aimed at the domestic production of goods previously imported, the exploitation of existing and the development of new export opportunities via the establishment of a fully integrated industrial sector.

D. Suggestions for Further Research

Our study indicates a number of areas worthy of further investigation including:

1. Analysis of government expenditure and revenue data on a disaggregated basis, in order to throw light on how domestic budget deficits are moderated, as well as on possible future developments.
2. A more detailed analysis of the determinants of domestic liquidity expansion that takes into account developments in private sector balance of payments deficits and that sector's use of domestic bank credit.
3. Finally, the study highlights the need for a considerable improvement in the macroeconomic data that are essential for successful formulation of the problem and implementation of appropriate economic policy.

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APPENDIX I

THE SHIFT OF THE BASE YEAR FOR CALCULATION OF A VARIABLE AT CONSTANT PRICES

Several times in the course of this study it will be necessary to calculate a variable at constant prices of a given year (1959). Since almost all of constant price estimates of different variables that have been published by various sources are based on prices of different years (1975 for example in recent I. M. F. and U. N. publications), we will require a mechanism to convert these estimates to those based on the prices of another year, 1959. In order to do so we will use the following relationship:

$$V(t,s) = [V(s,s)/V(s,0)][V(t,0)]$$

where:

$V(t,s)$ = Value of variable at time 't' calculated at prices of period 's' (i.e. new base year, 1959); and

$s = 0$, is the given base year (i.e. old base year, 1975).

For example, in order to calculate the consumer price index of 1977 when 1959=100, using the data supplied in I.F.S.[250] which are reported at 1975=100, one could write:

$$P(1977,1959) = [P(1959,1959)/P(1959,1975)][P(1977,1975)]$$

that is:

$$P(1977,1959) = (100/48.8)(141.7) = 290.40$$

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[250] I. M. F., *International Financial Statistics*, Yearbook 1980, pp. 226-227.

this figure is the value of the consumer price index in 1977 with 1959 as the base year.

APPENDIX II

LINEAR APPROXIMATION IN GROWTH RATES OF THE MODEL

This appendix provides a brief summary of the derivation of the linear approximation of the system used in the text.

Differentiating equations 6 to 14 of our model in table VI-5 with respect to time yields the following results.

Estimated Demand for Money Equation:

6-a) $(\dot{Y}/Y) = 0.79(\dot{M}1/M1) - 0.64(\dot{P}/P) + 0.35d(\dot{P}/P)/dt$

6-b) $(\dot{Y}/Y) = 0.65(\dot{M}2/M2) - 0.57(\dot{P}/P) + 0.41d(\dot{P}/P)/dt$

Money Supply Equation:

8-a) $(\dot{M}1/M1)=0.12(\dot{D}/D)+0.11(\dot{B}P/BP)+1.10(\dot{M}1/M1)_{-1}$

8-a) $(\dot{M}2/M2)=0.12(\dot{D}/D)+0.11(\dot{B}P/BP)+1.10(\dot{M}2/M2)_{-1}$

Government Budget Deficit:

$D = G - R$

$\mathrm{Log}(D) = \mathrm{Log}(G - R)$

Linearizing this equation about the sample mean of the logarithms of the variables, using the Taylor Series expansion:

$$\mathrm{Log}(D) = \mathrm{Log}(e^{\mathrm{Log}G} - e^{\mathrm{Log}R})$$

$$\mathrm{Log}(D) = \mathrm{Log}(e^{\overline{\mathrm{LogG}}} - e^{\overline{\mathrm{LogR}}}) +$$

$$[e^{\overline{\mathrm{LogG}}} / (e^{\overline{\mathrm{LogG}}} - e^{\overline{\mathrm{LogR}}})][\mathrm{LogG} - \overline{\mathrm{LogG}}] -$$

$$[e^{\overline{\mathrm{LogR}}} / (e^{\overline{\mathrm{LogG}}} - e^{\overline{\mathrm{LogR}}})][\mathrm{LogR} - \overline{\mathrm{LogR}}]$$

Differentiating with respect to time:

$$(\dot{D}/D) = [e^{\overline{\mathrm{LogG}}} / (e^{\overline{\mathrm{LogG}}} - e^{\overline{\mathrm{LogR}}})](\dot{G}/G) -$$

$$[e^{\overline{\mathrm{LogR}}} / (e^{\overline{\mathrm{LogG}}} - e^{\overline{\mathrm{LogR}}})](\dot{R}/R)$$

The values of the parameters was then obtained by calculating the sample means of the logrithms of the variables G and R as follows:

$$[e^{\overline{\mathrm{LogG}}} / (e^{\overline{\mathrm{LogG}}} - e^{\overline{\mathrm{LogR}}})] = 1.51$$

$$[e^{\overline{\mathrm{LogR}}} / (e^{\overline{\mathrm{LogG}}} - e^{\overline{\mathrm{LogR}}})] = 0.51$$

Then:

$$(\dot{D}/D) = 1.51(\dot{G}/G) - 0.51(\dot{R}/R)$$

Government Expenditure Equation:

$$[(\dot{G/P})/(G/P)] = 0.95(\dot{Y}/Y) + 0.46[(\dot{G/P})/(G/P)]_{-1}$$

Government Revenue Equation:

$$(\dot{R}/R) = 0.30(\dot{Y}/Y) + 0.30(\dot{P}/P) + 0.78(\dot{R}/R)_{-1}$$

Balance of Payments:

$$BP = X.Px + Xoil.Poil - Z.Pz + K$$

$$Log(BP) = Log(\ X.Px + Xoil.Poil - Z.Pz + K\ )$$

Using Taylor Series expansion and linearizing this equation about the sample means of the logarithms of the variables yield:

$$\begin{aligned} Log(BP) = A &+ (e^{\overline{LogX.Px}}/A)(LogX.Px - \overline{LogX.Px}) + \\ &(e^{\overline{LogXoil.Poil}}/A)(LogXoil.Poil - \overline{LogXoil.Poil}) - \\ &(e^{\overline{LogZ.Pz}}/A)(LogZ.Pz - \overline{LogZ.Pz}) + \\ &(e^{\overline{LogK}}/A)(LogK - \overline{LogK}) \end{aligned}$$

where:

$$A = Log(e^{\overline{LogX.Px}} + e^{\overline{LogXoil.Poil}} - e^{\overline{LogZ.Pz}} + e^{\overline{LogK}})$$

Differentiating with respect to time:

$$\text{Log}(BP) = A + (e^{\overline{\text{Log}X.Px}} / A)(\dot{XPx}/XPx) +$$

$$(e^{\overline{\text{Log}Xoil.Poil}} / A)(\dot{XoilPoil}/XoilPoil) -$$

$$(e^{\overline{\text{Log}Z.Pz}} / A)(\dot{ZPz}/ZPz) +$$

$$(e^{\text{Log}K} / A)(\dot{K}/K)$$

Calculating the sample means of the logarithms of the variables X.Px, Xoil.Poil, Z.Pz and K results in the following:

$$e^{\overline{\text{Log}X.Px}} /A = 0.06$$

$$e^{\overline{\text{Log}Xoil.Poil}} /A = 0.65$$

$$e^{\overline{\text{Log}Z.Pz}} /A = 0.43$$

$$e^{\overline{\text{Log}K}} /A = 0.72$$

or:

$$(\dot{BP}/BP) = 0.06(\dot{XPx}/XPx) + 0.65(\dot{XoilPoil}/XoilPoil) -$$

$$0.43(\dot{ZPz}/ZPz) + 0.72(\dot{K}/K)$$

Imports Equation:

$$(\dot{Z}/Z) = 0.89(\dot{Y}/Y) - 0.57(\dot{P}z/Pz) + 0.57(\dot{P}/P) + 0.44(\dot{Z}/Z)_{-1}$$

The reduced form results of all these transformed equations are used in the dynamic simulation analysis of the model.

APPENDIX III

ACTUAL AND SIMULATED VALUES OF DEPENDENT VARIABLES

Figure AIII-1

Simulation II: $\dot{F}/F$

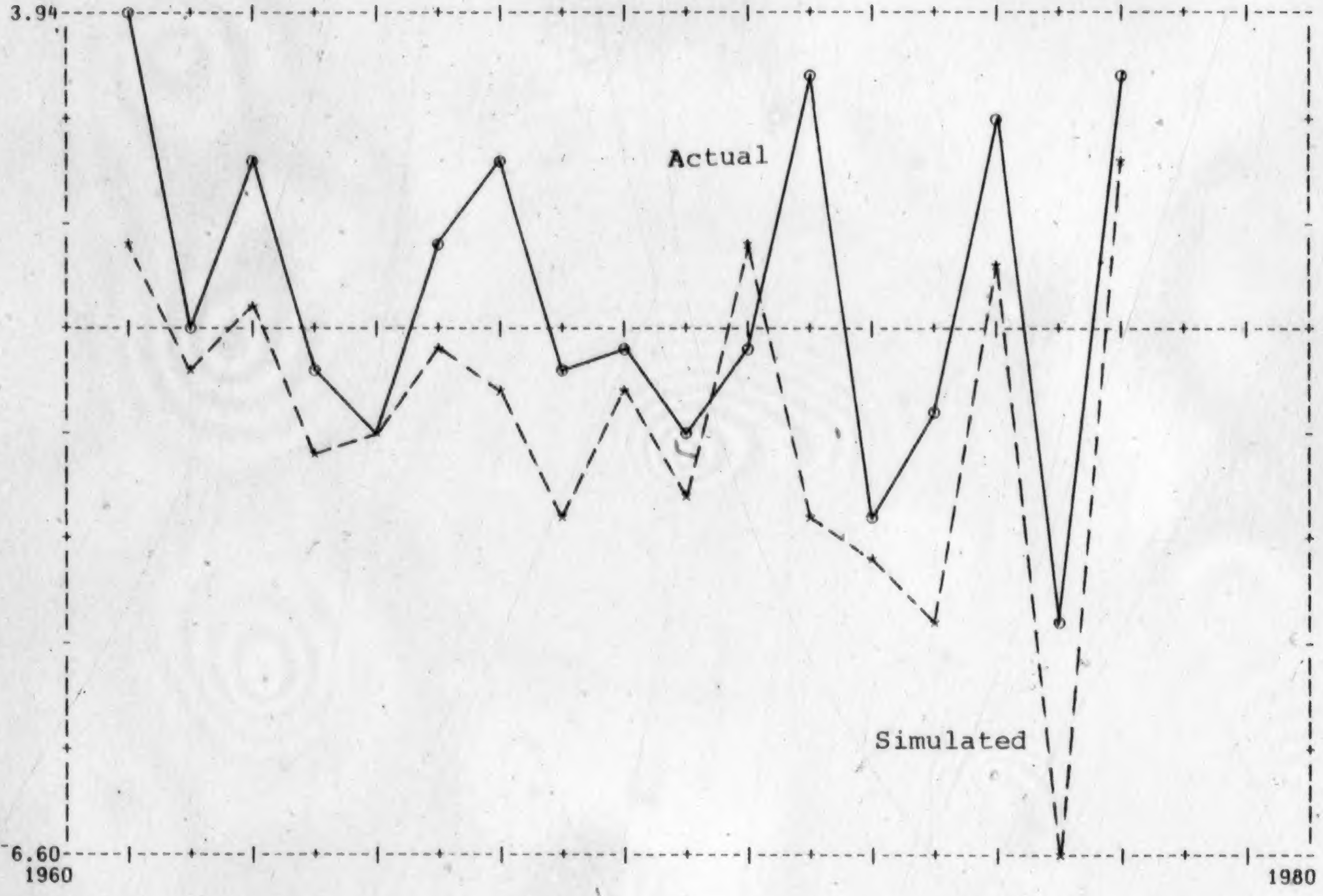

Figure AIII-2

Simulation II: $\dot{P}a/Pa$

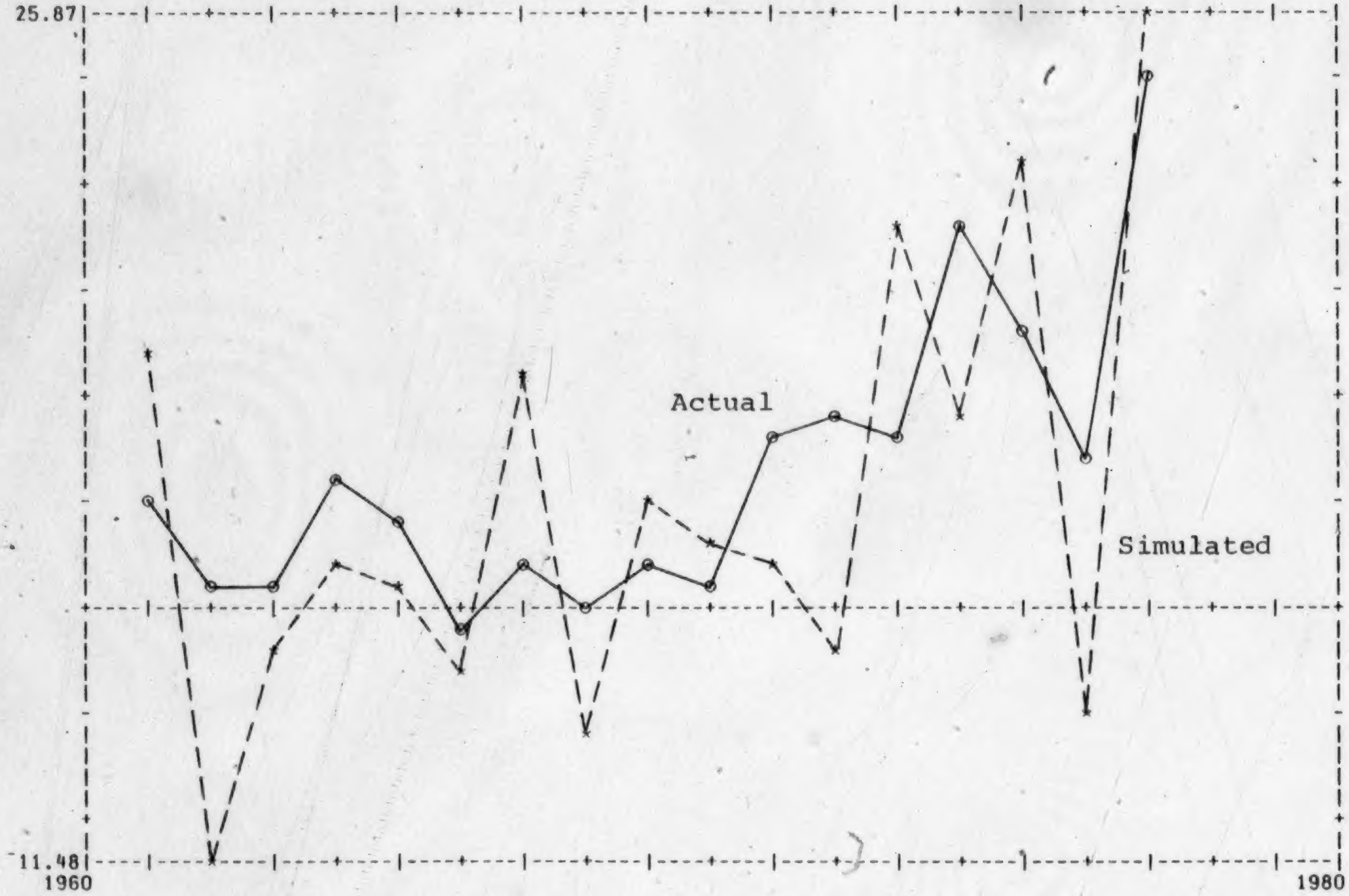

Figure AIII-3

Simulation II: $\dot{P}i/Pi$

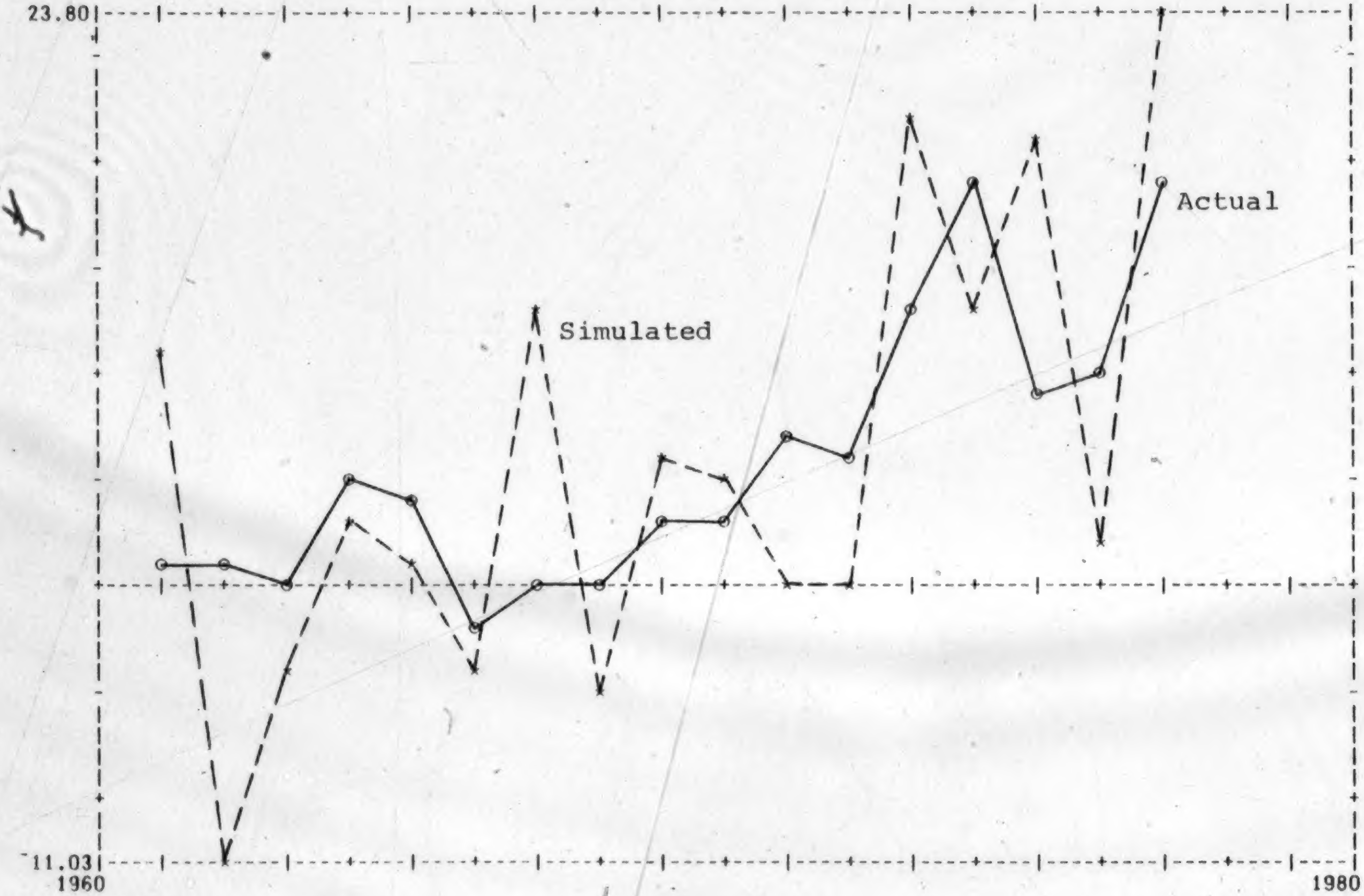

Figure AIII-4

Simulation II: $\dot{P}/P$

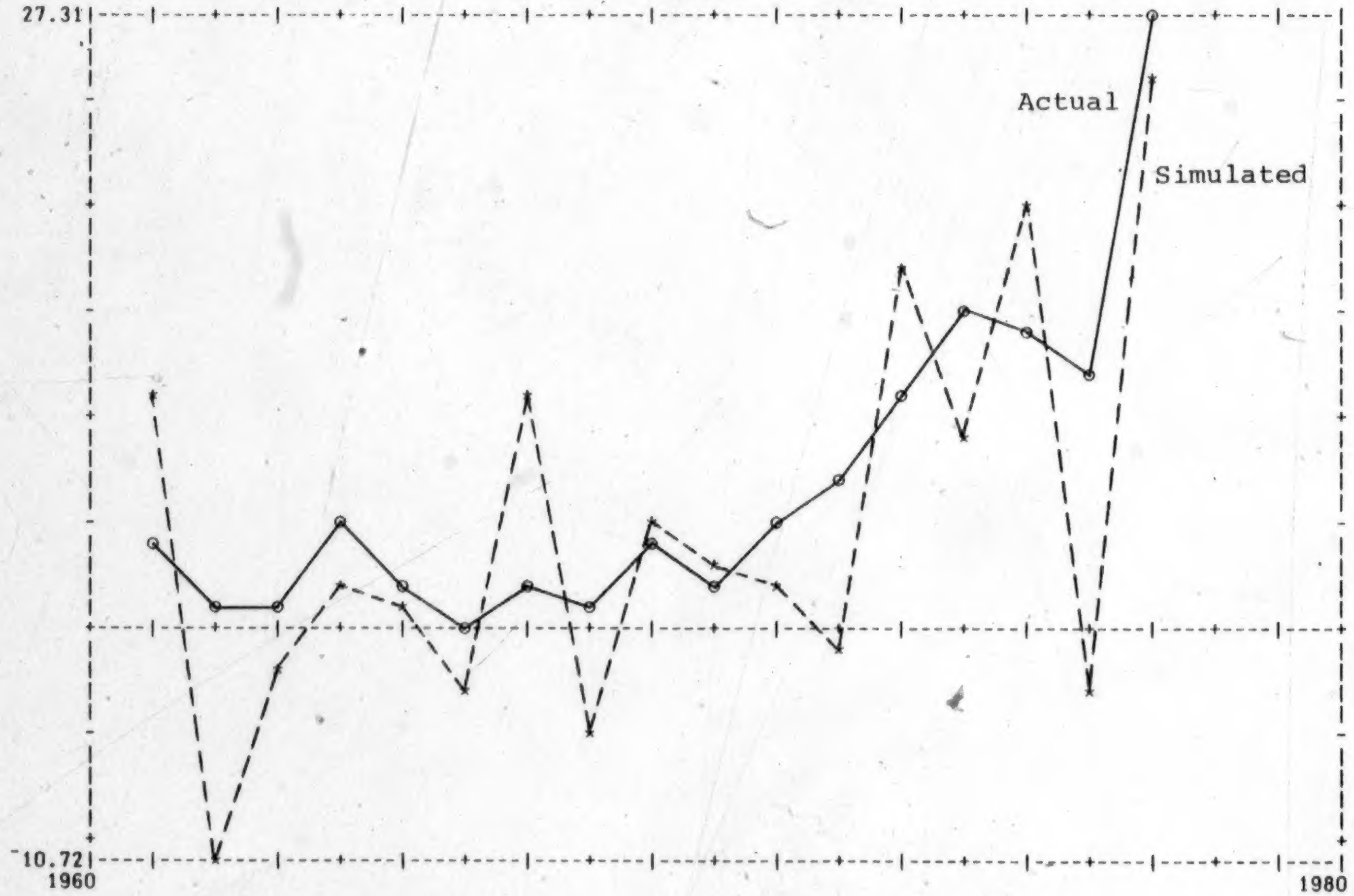

Figure AIII-5

Simulation II: $\dot{W}/W$

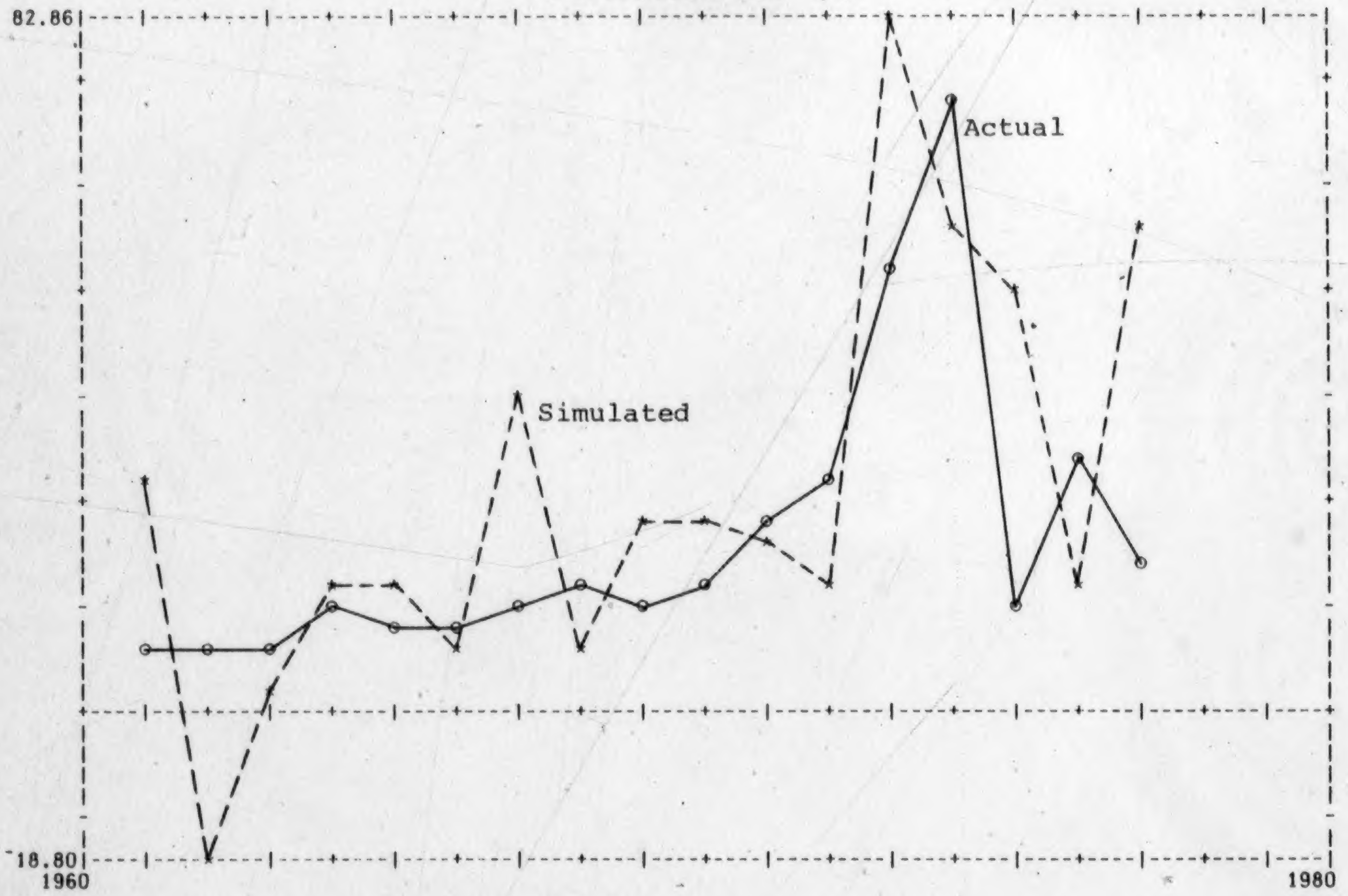

Figure AIII-6

Simulation II: U

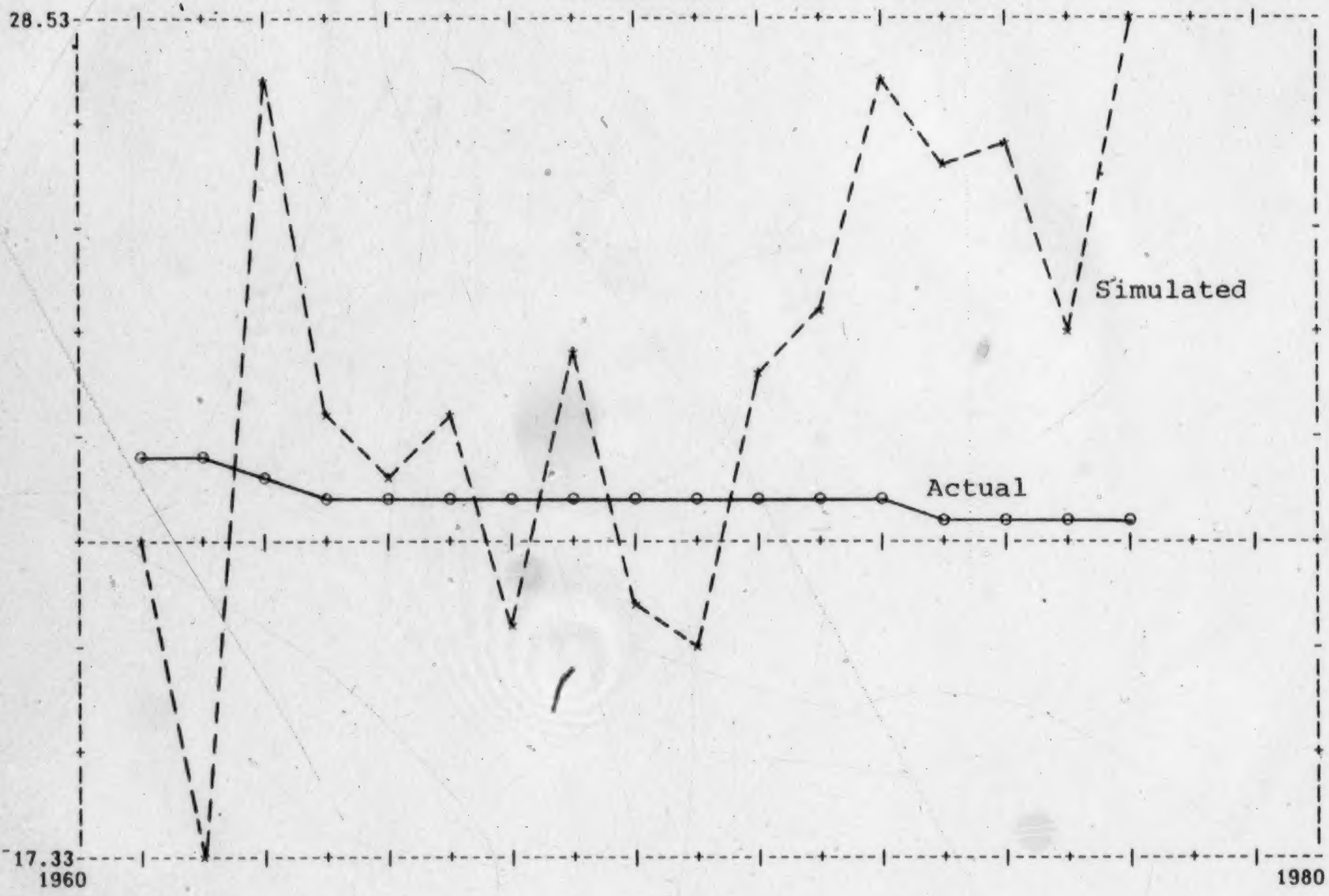

Figure AIII-7

Simulation II: $\dot{Y}/Y$

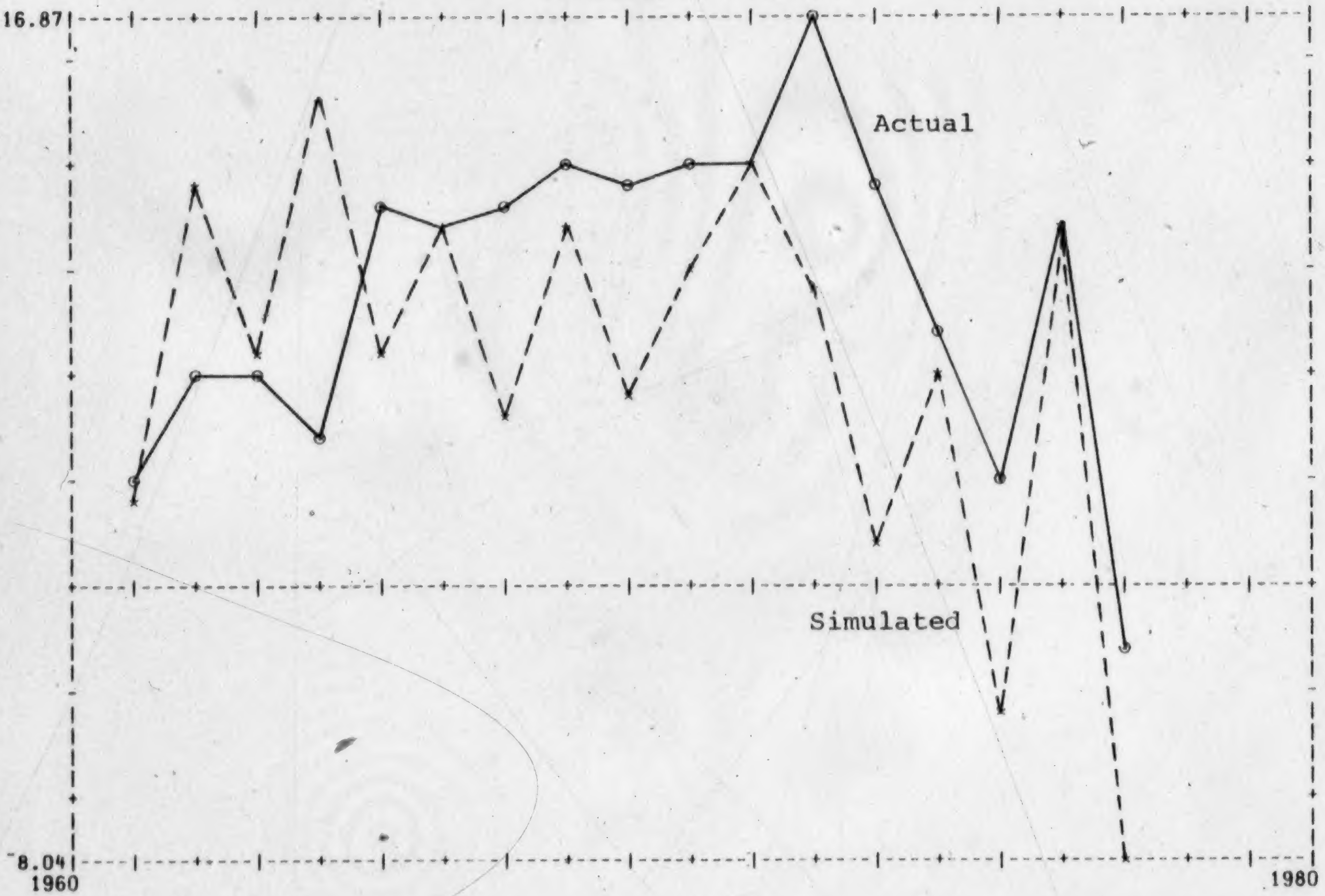

Figure AIII-8

Simulation II: $\dot{M}/M$

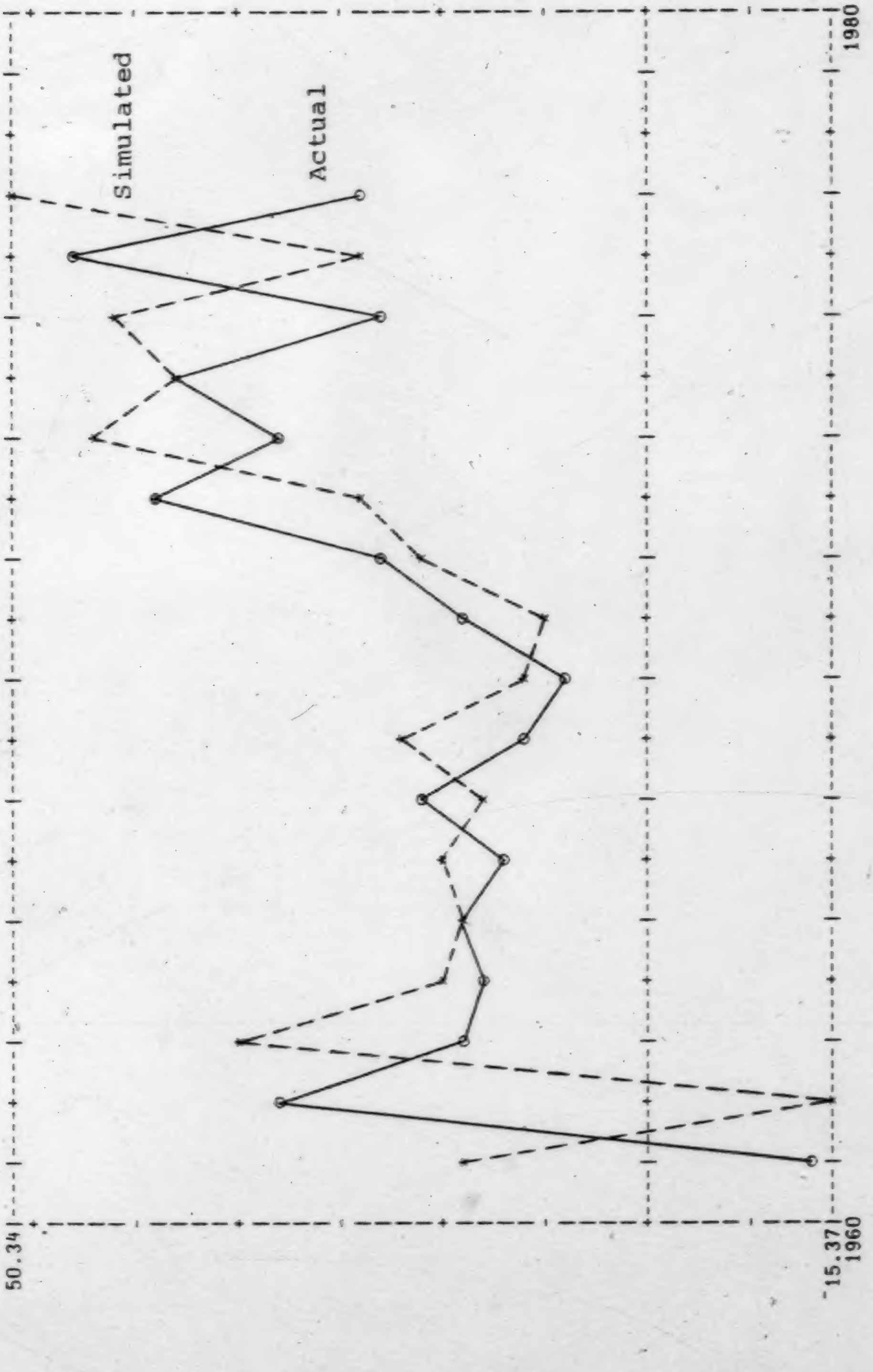

Figure AIII-9

Simulation II: $\dot{D}/D$

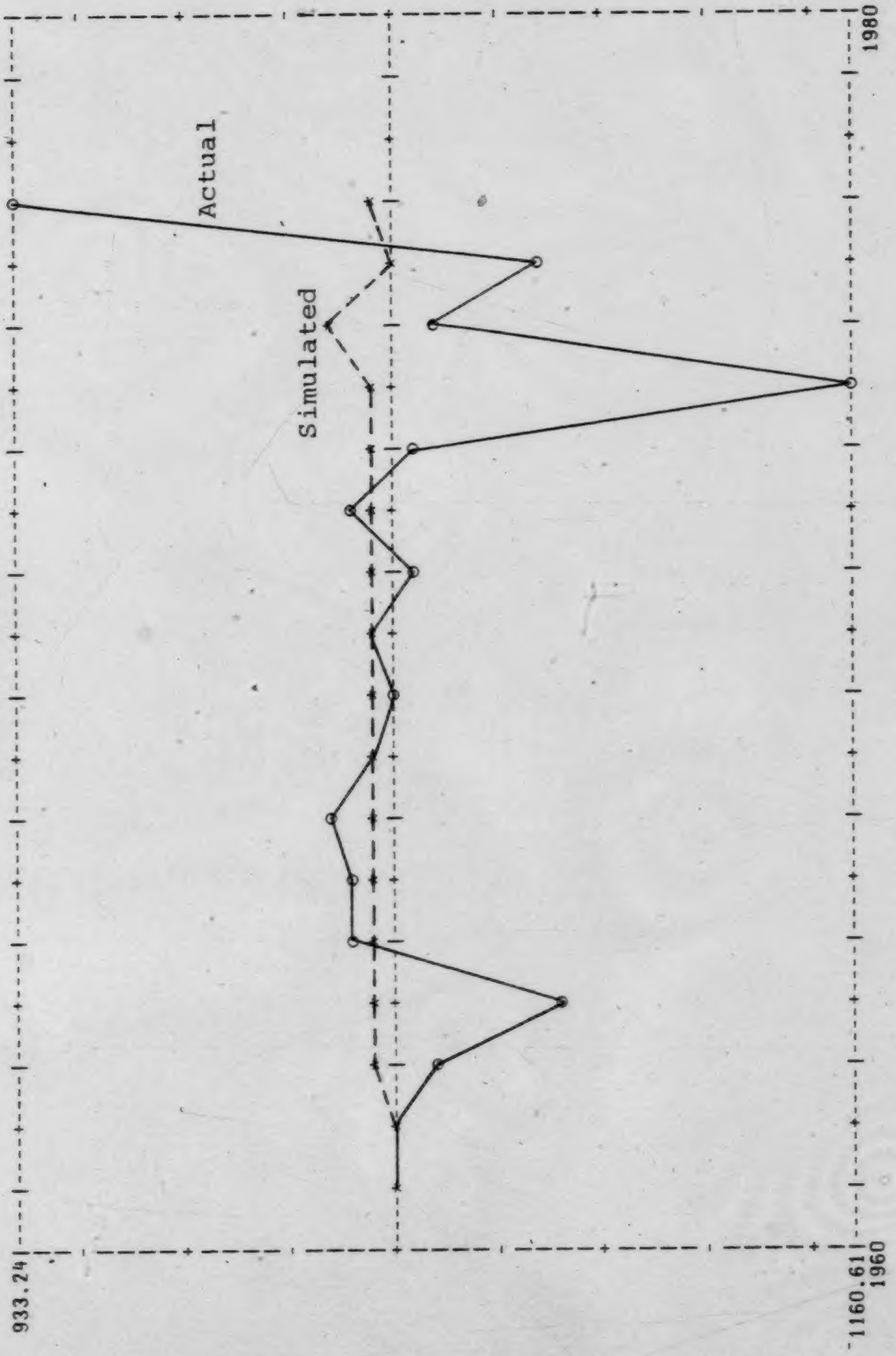

Figure AIII-10

Simulation II: $\dot{G}/G$

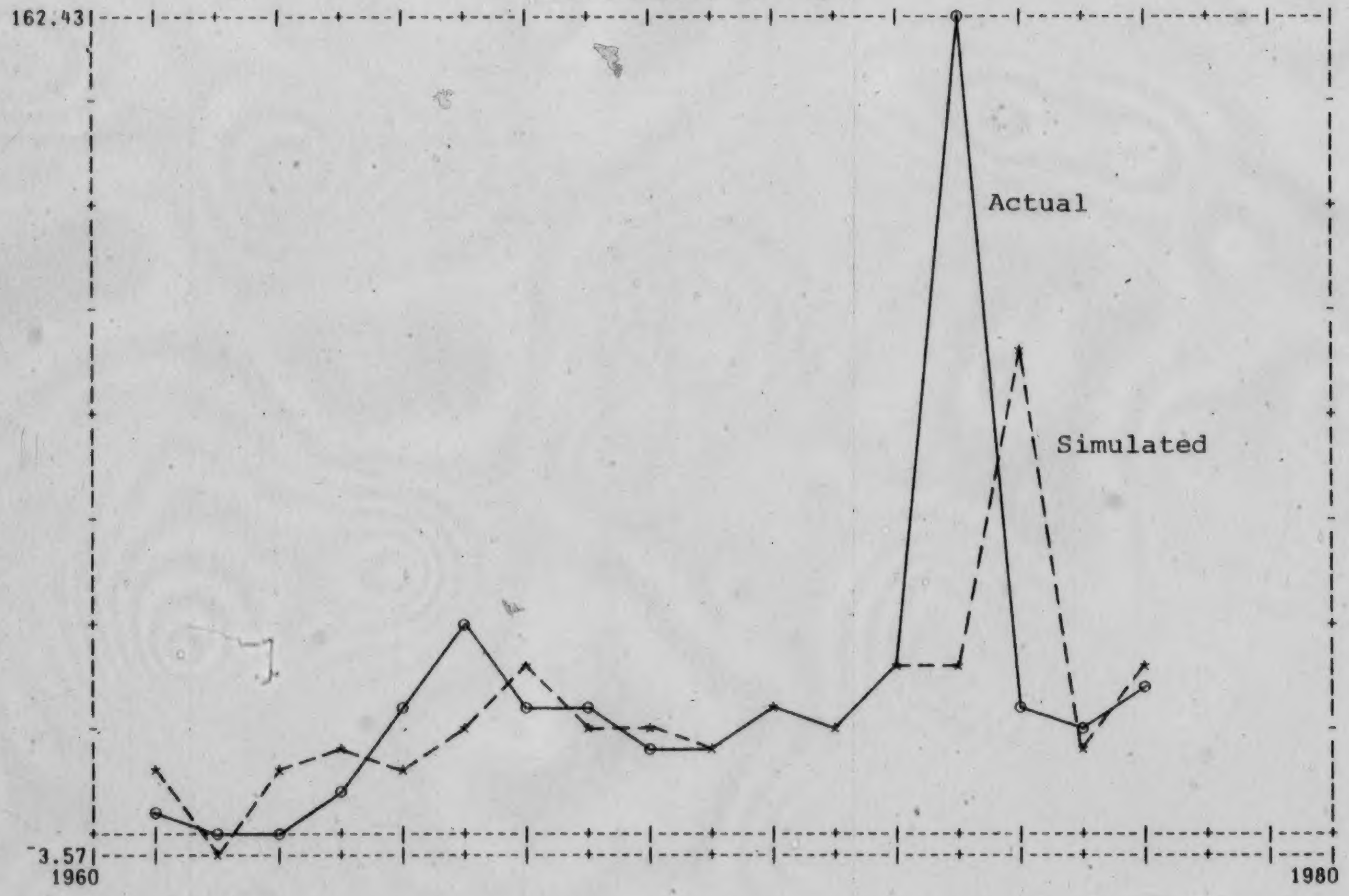

Figure AIII-11

Simulation II: $\dot{R}/R$

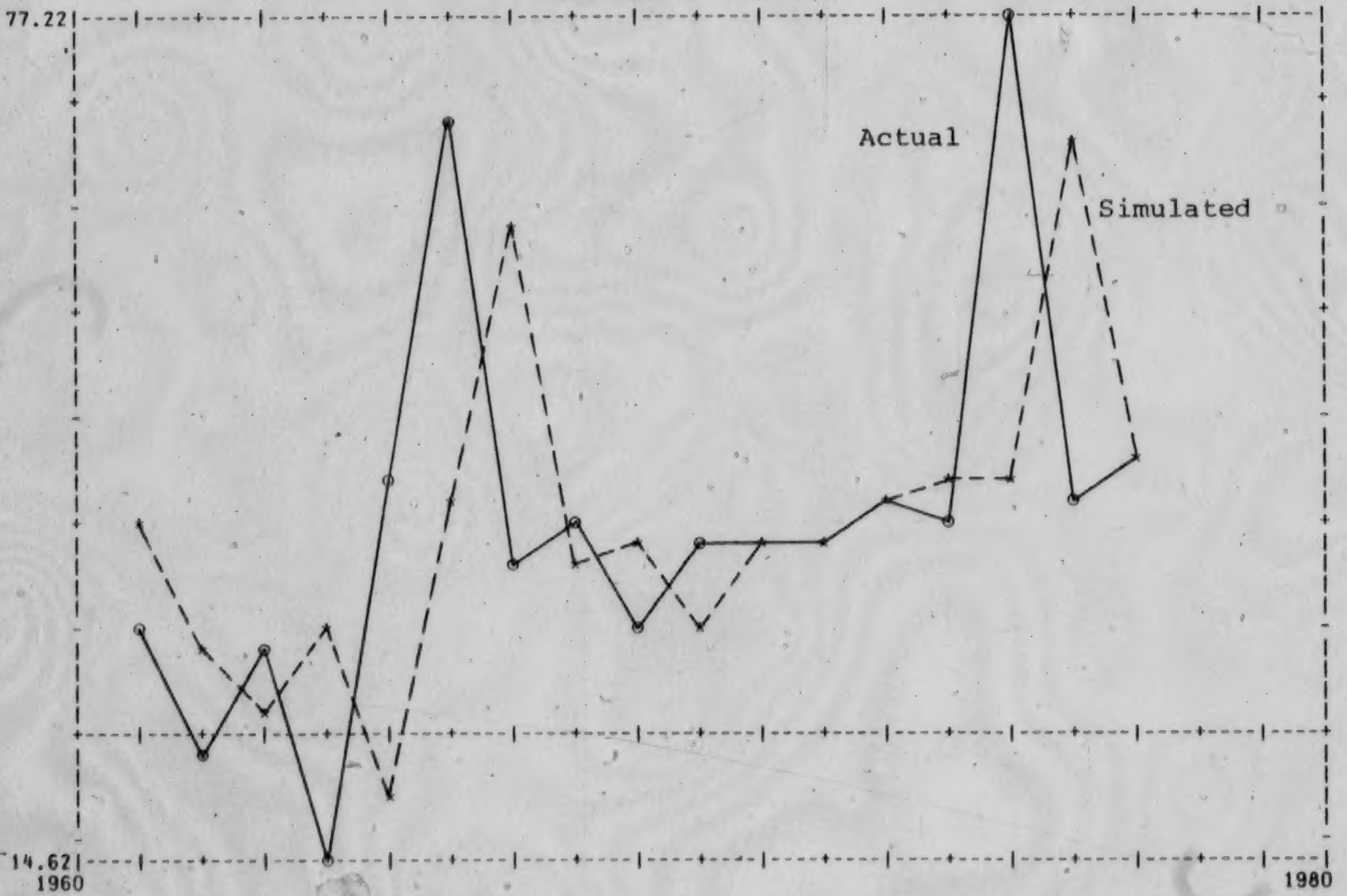

Figure AIII-12

Simulation II: $\dot{\mathrm{B}}\mathrm{P}/\mathrm{BP}$

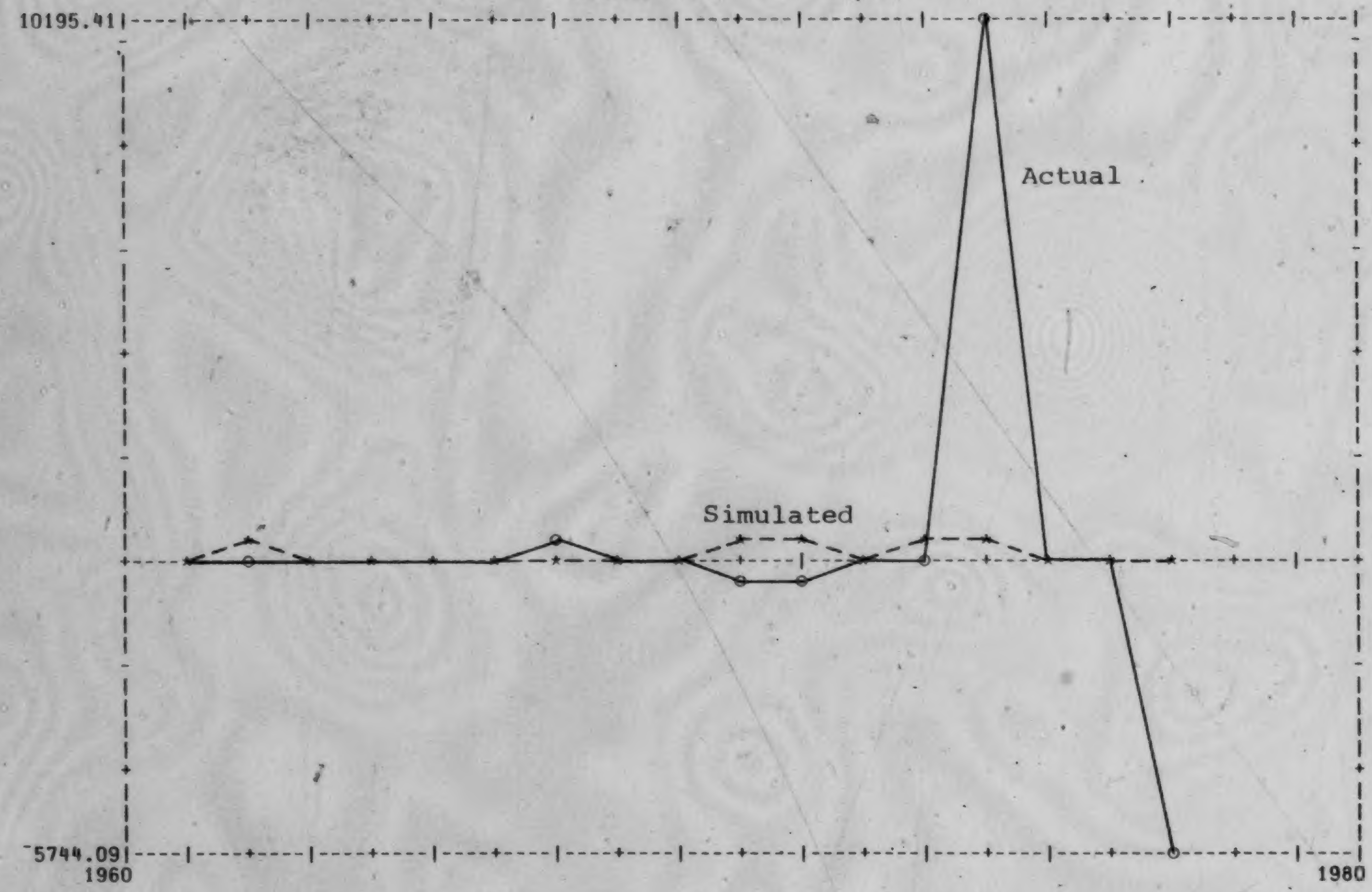

Figure AIII-13

Simulation II: $\dot{Z}/Z$

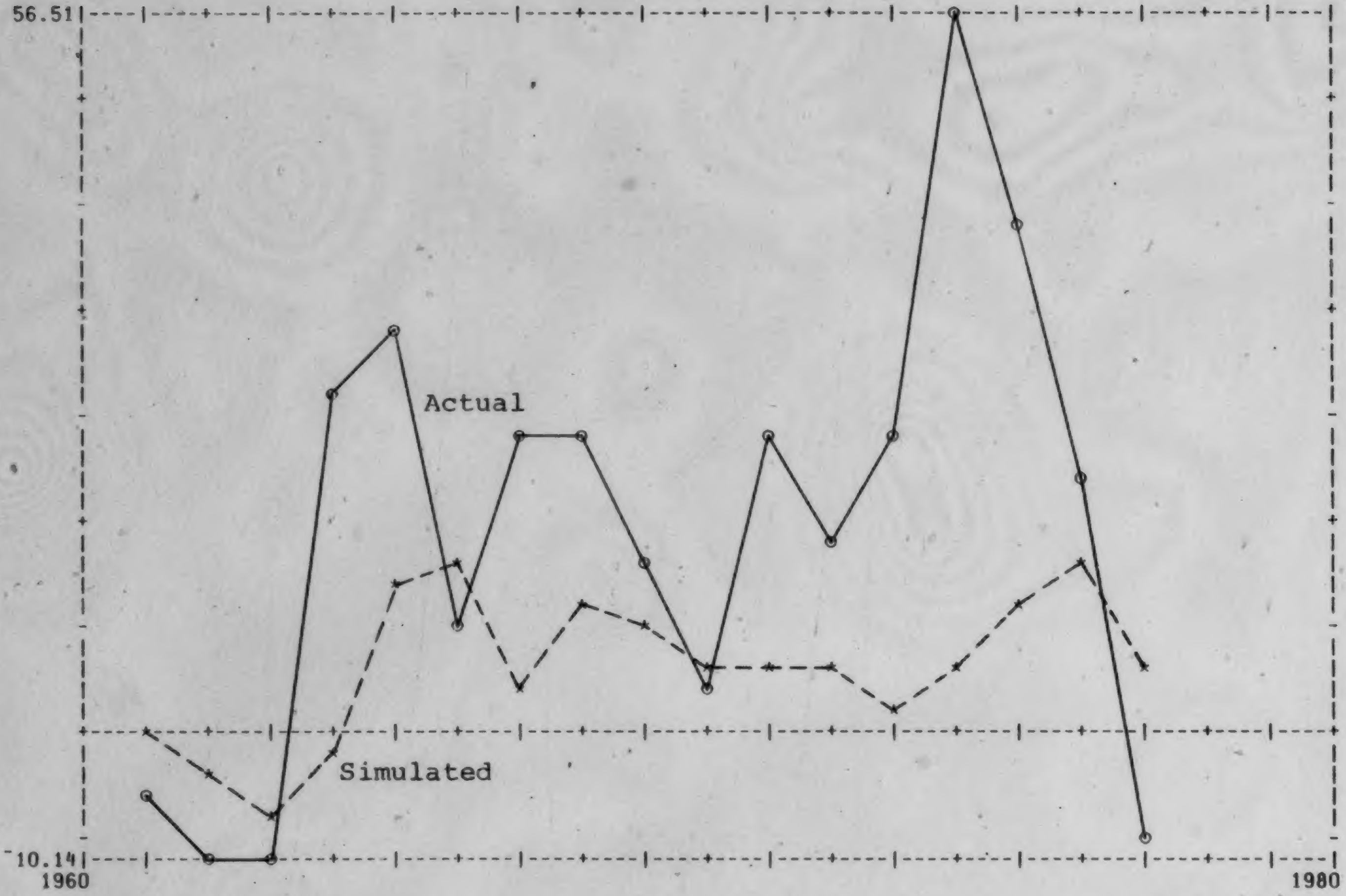

Figure AIII-14

Simulation III: $\dot{F}/F$

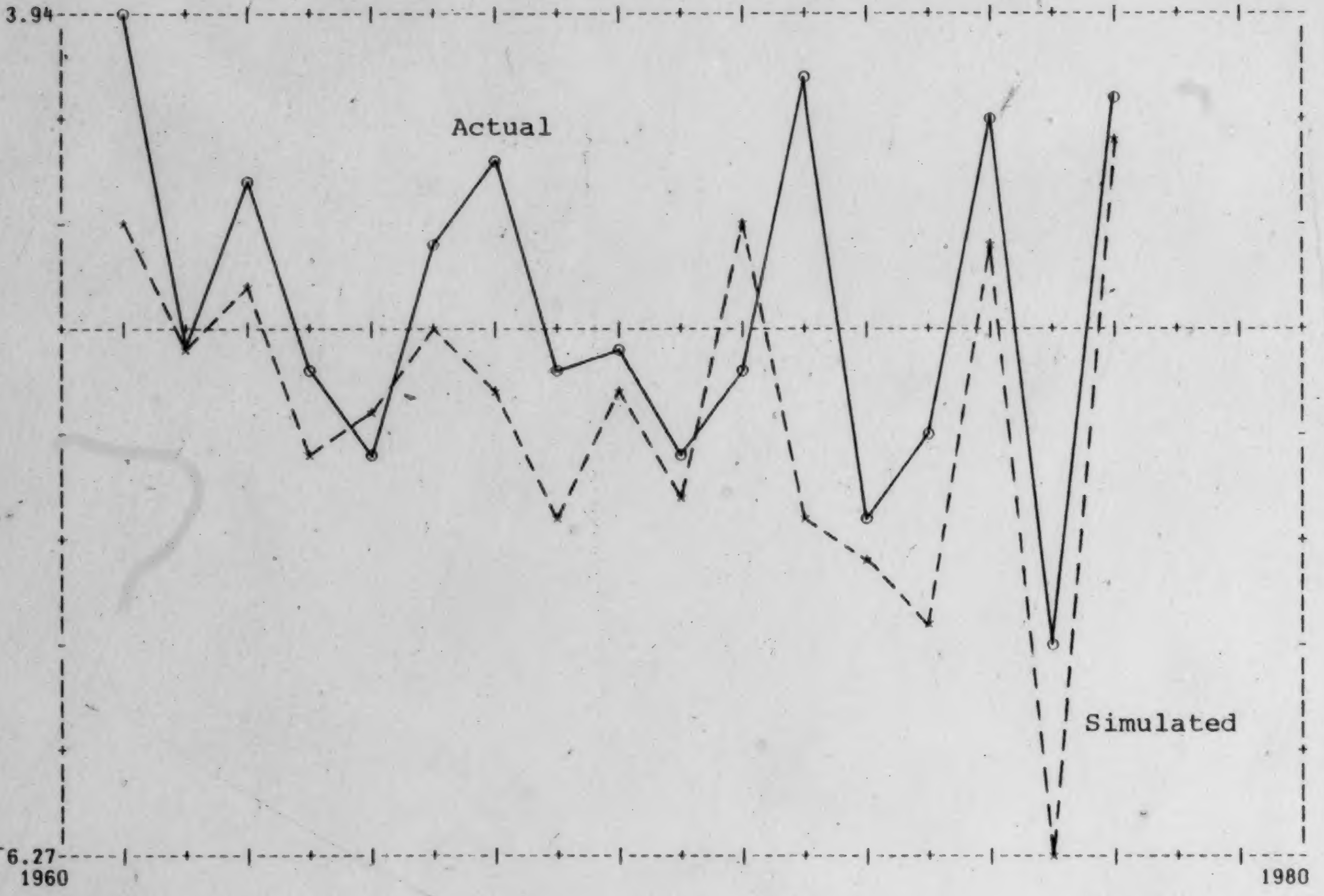

Figure AIII-15

Simulation III: $\dot{P}a/Pa$

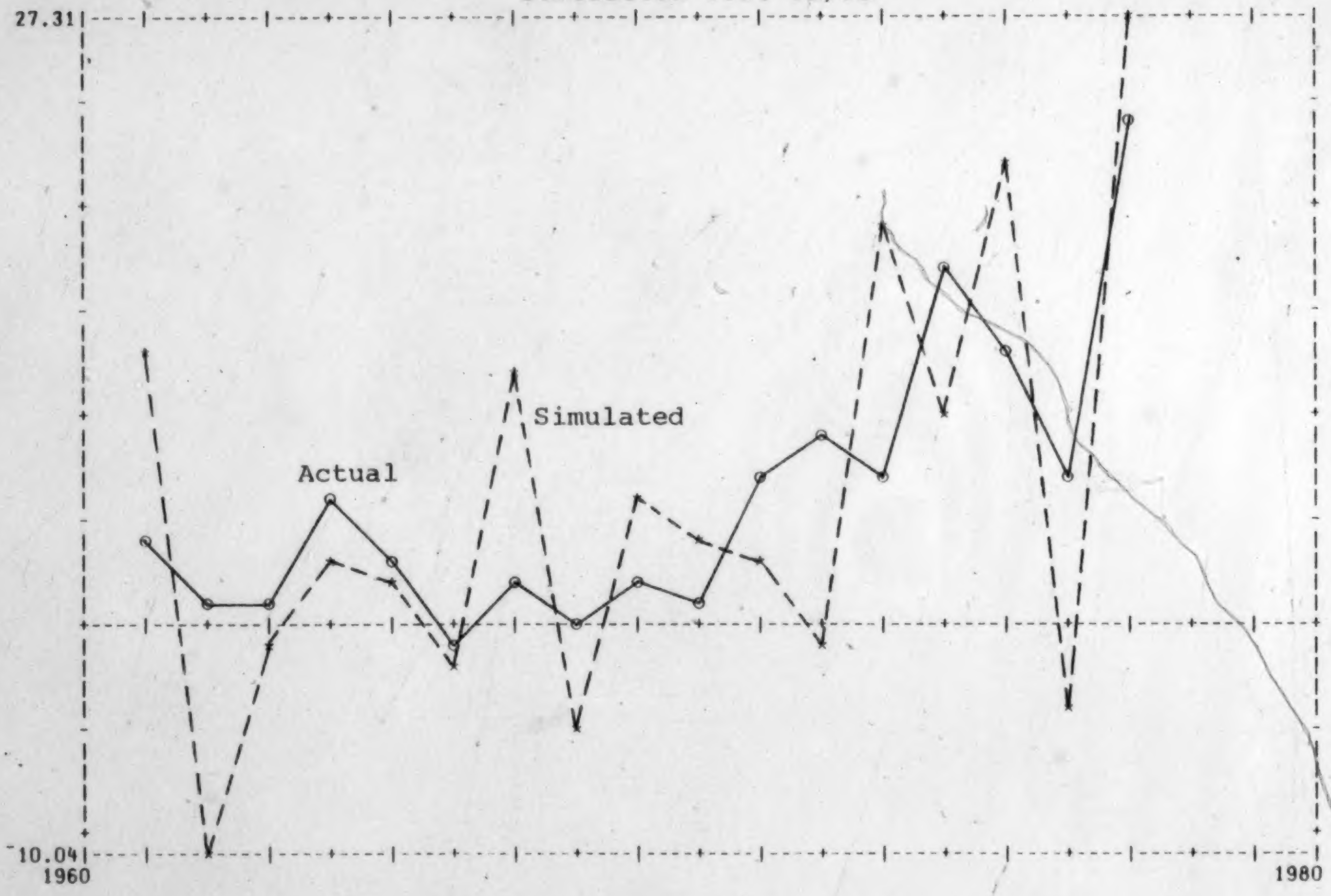

Figure AIII-16

Simulation III: $\dot{P}i/Pi$

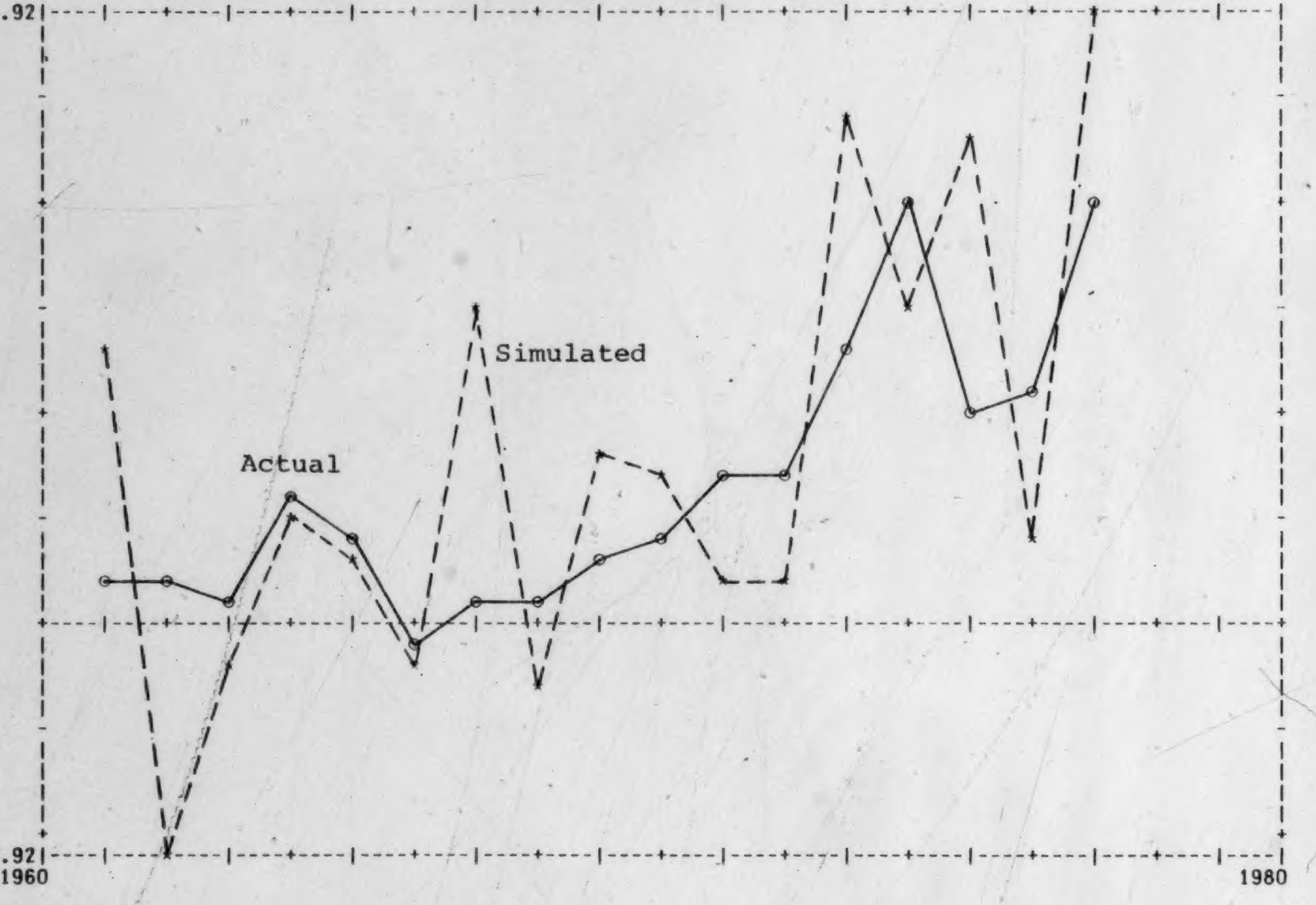

Figure AIII-17

Simulation III: $\dot{P}/P$

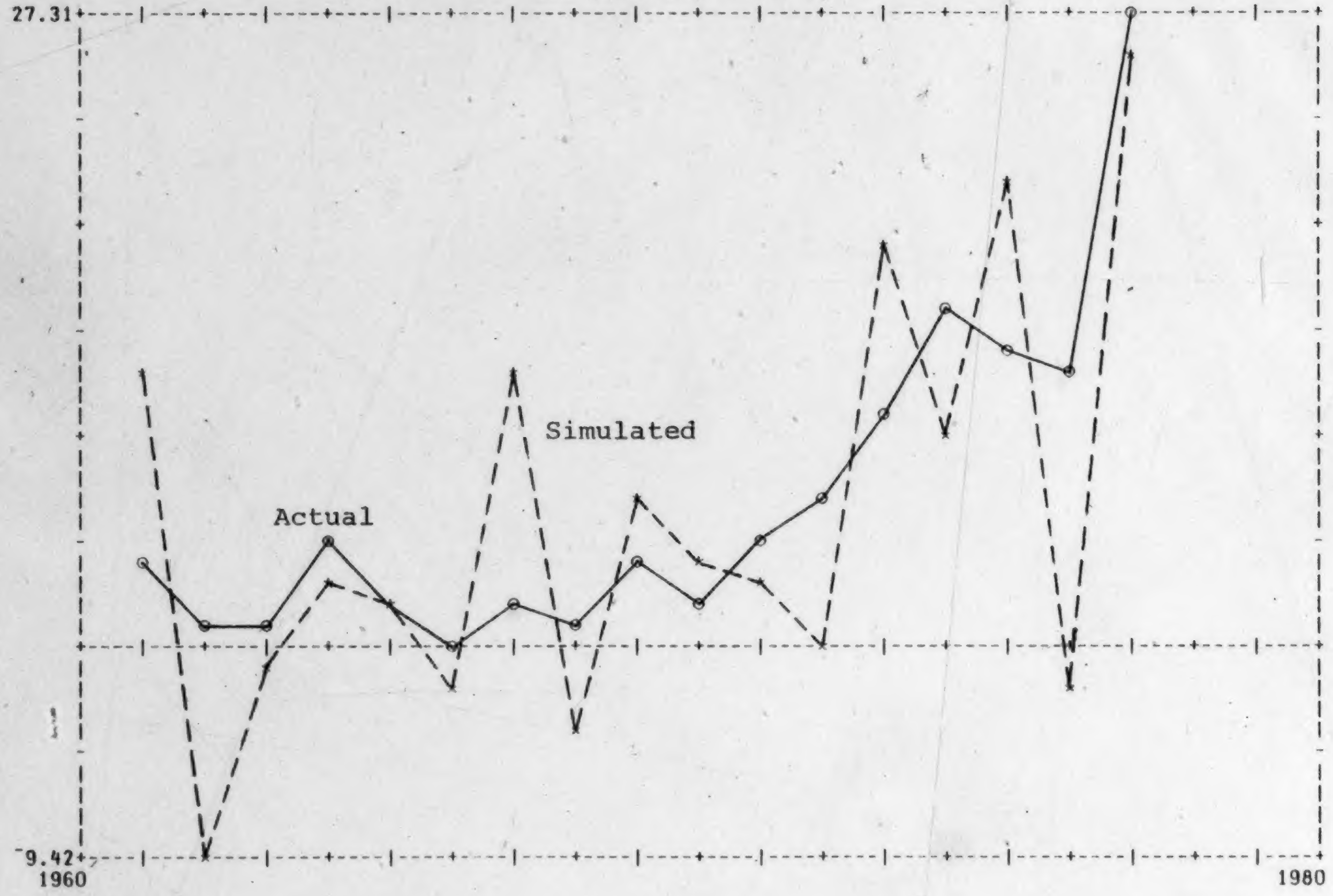

Figure AIII-18

Simulation III: $\dot{W}/W$

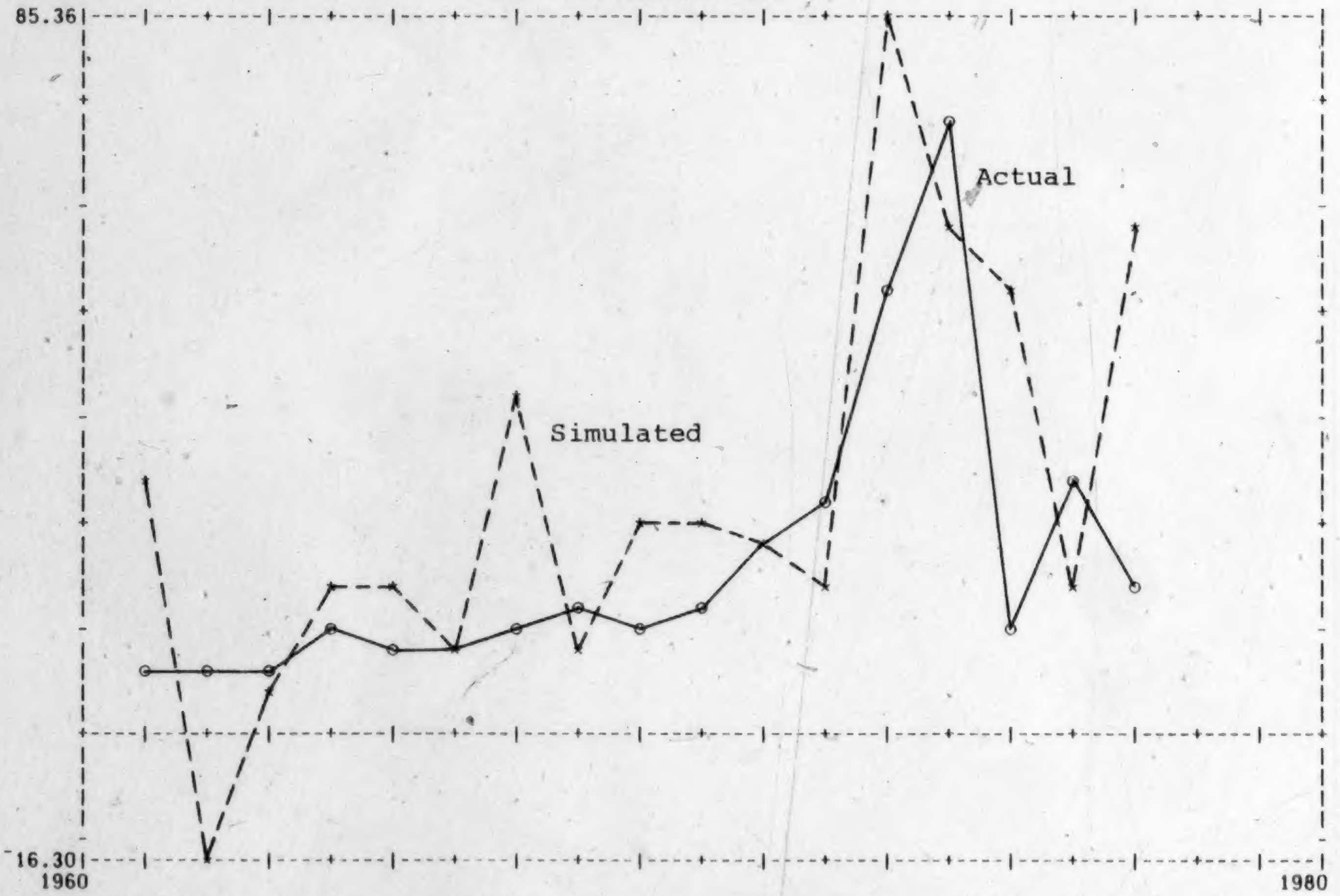

Figure AIII-19

Simulation III: U

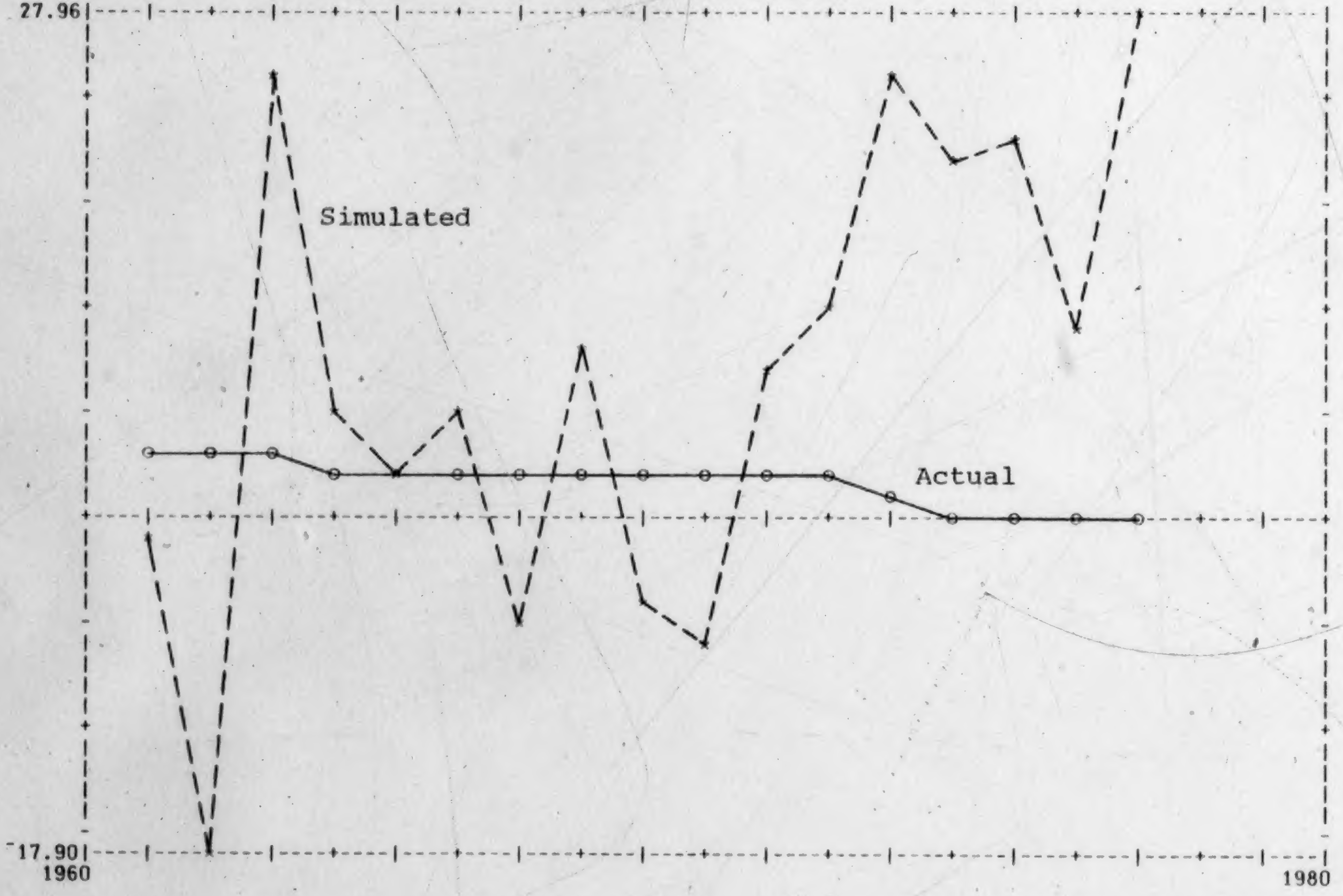

Figure AIII-20

Simulation III: $\dot{Y}/Y$

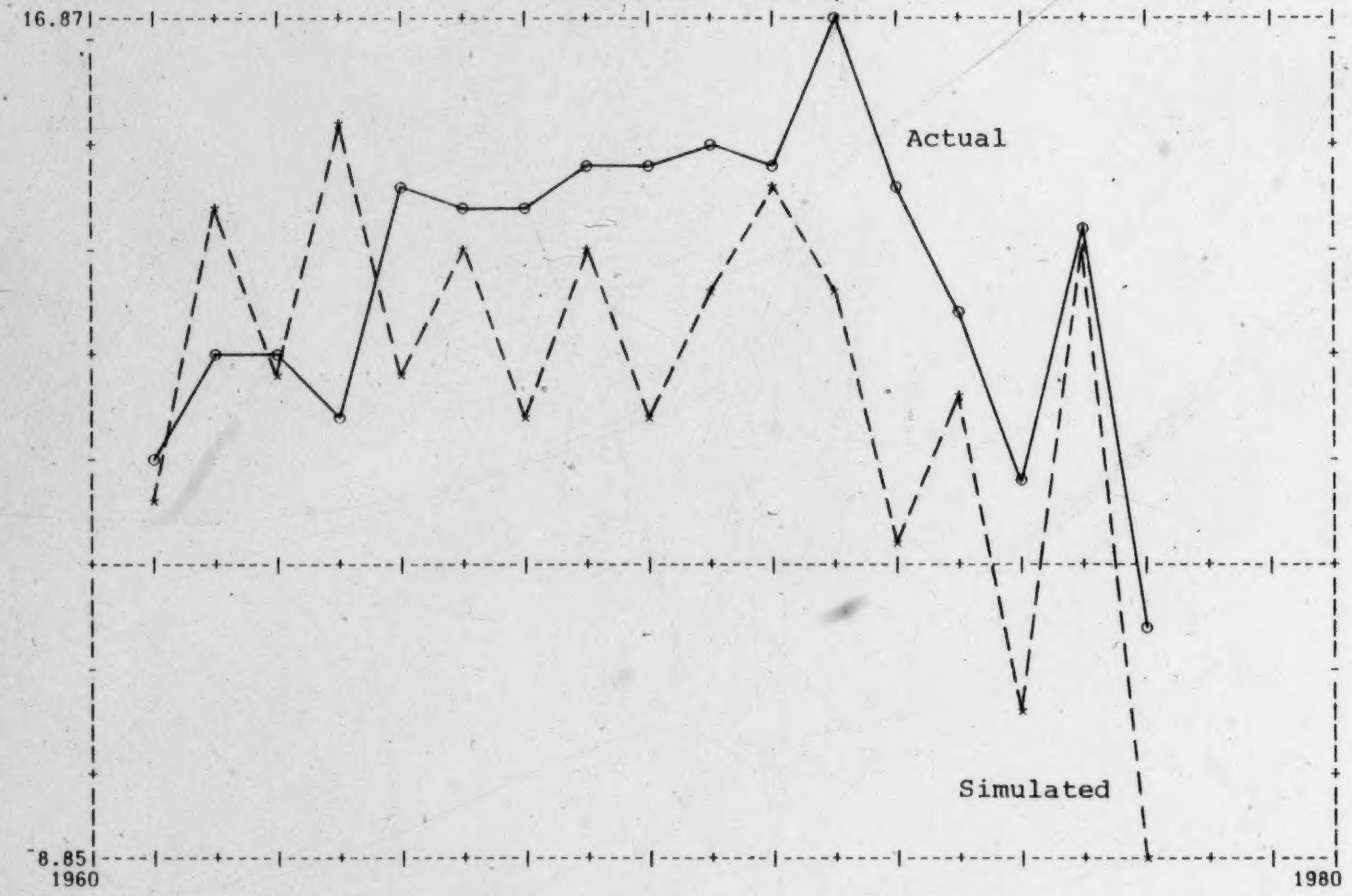

Figure AIII-21

Simulation III: $\dot{M}/M$

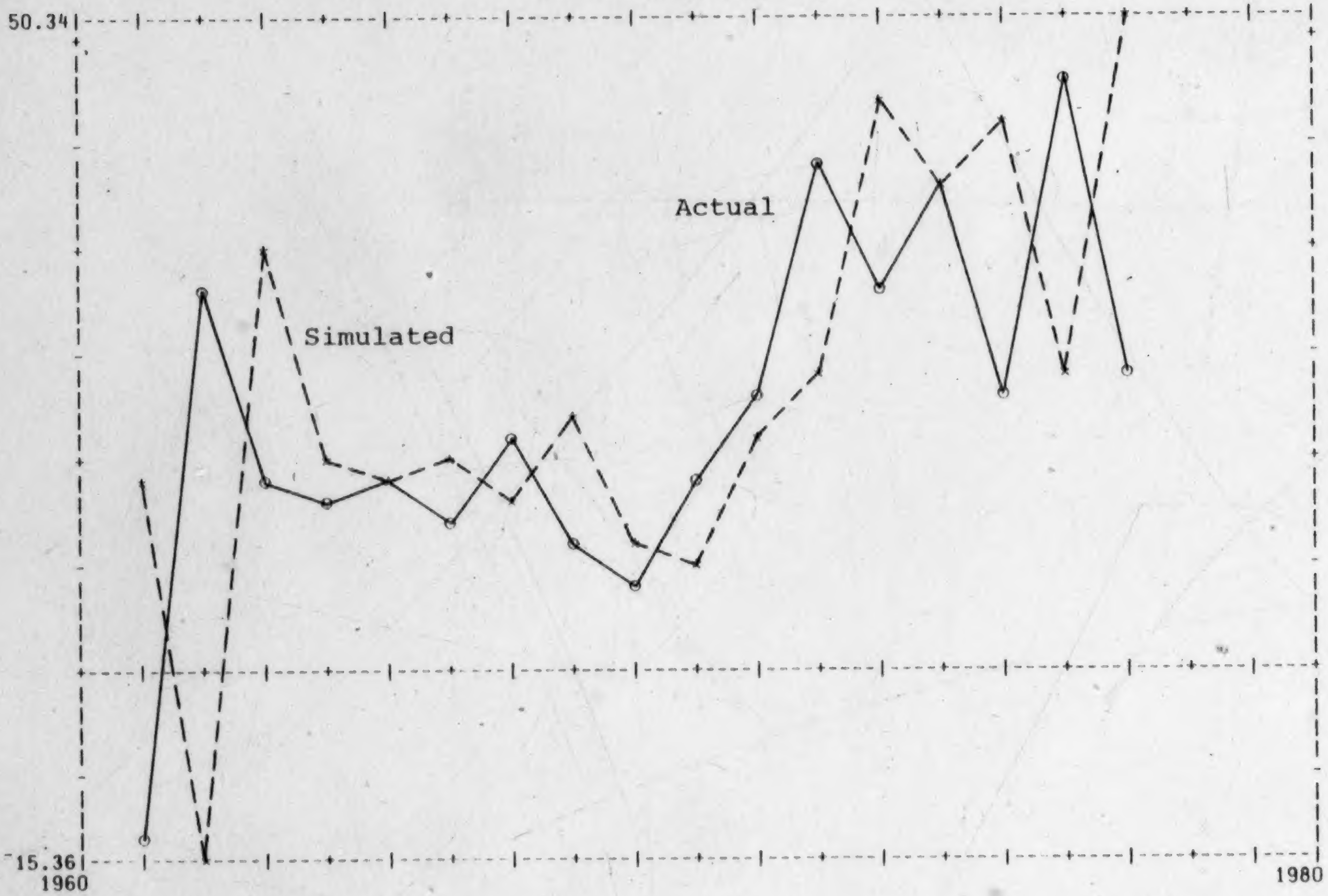

Figure AIII-22

Simulation III: $\dot{D}/D$

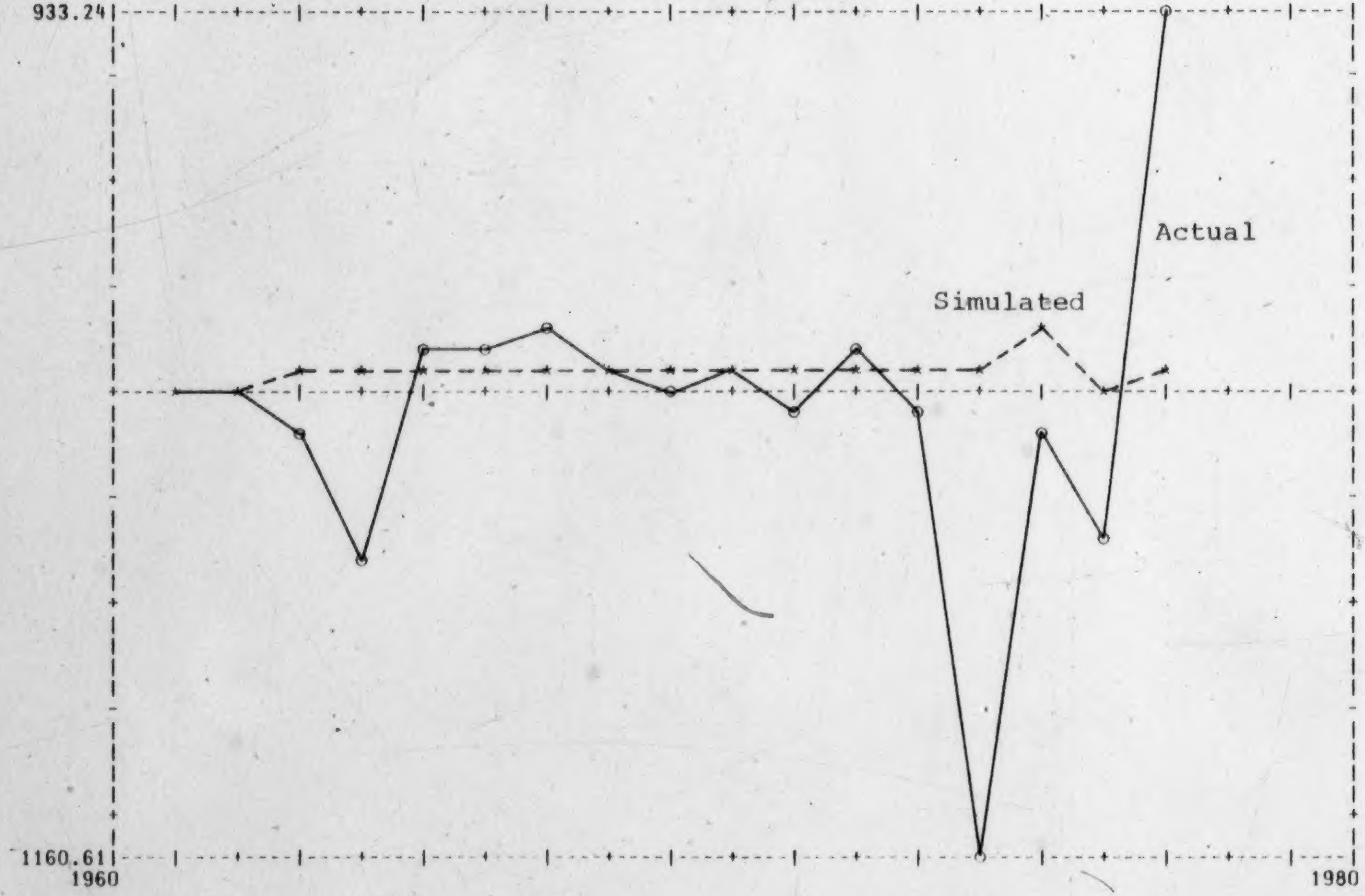

Figure AIII-23

Simulation III: $\dot{G}/G$

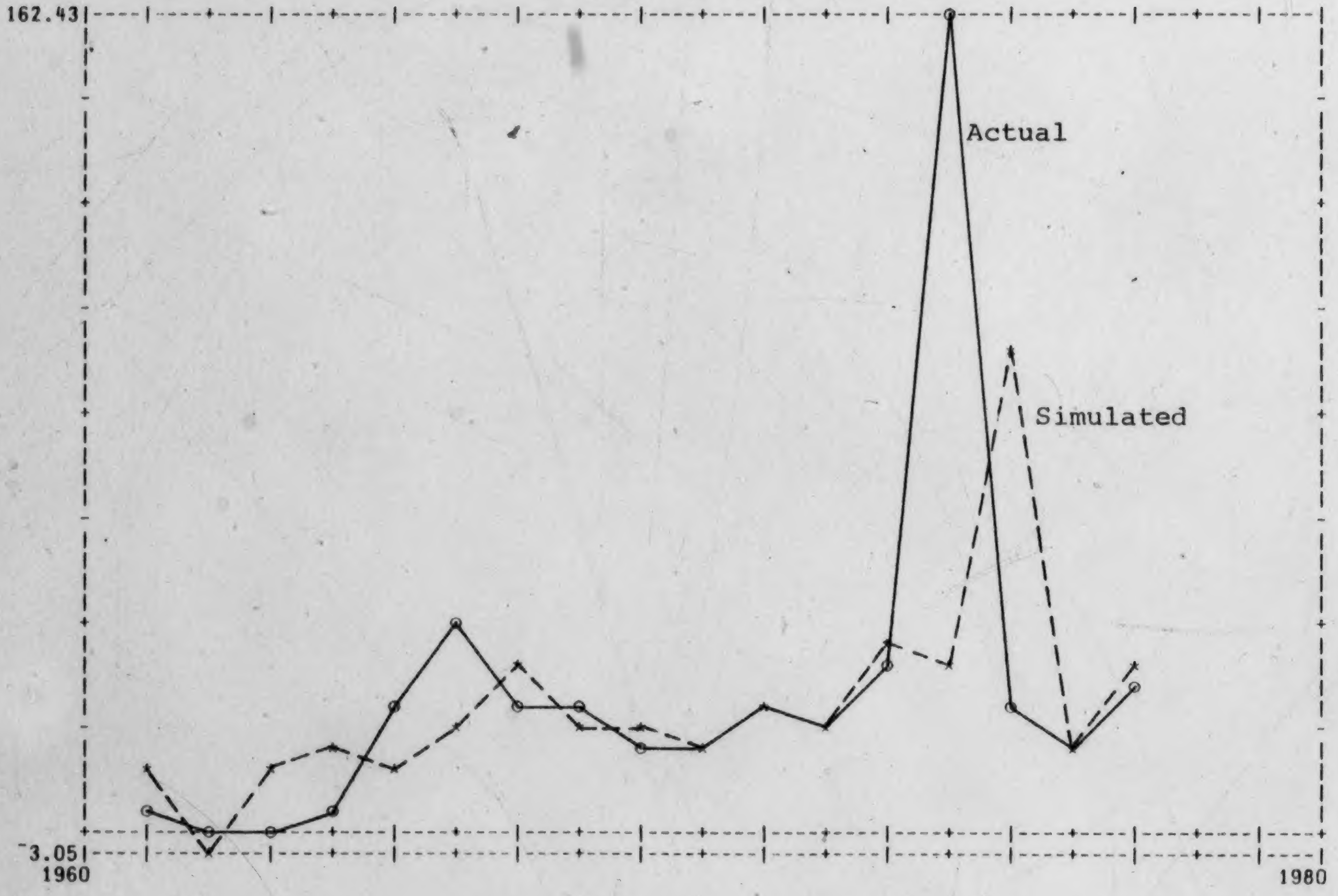

Figure AIII-24

Simulation III: $\dot{R}/R$

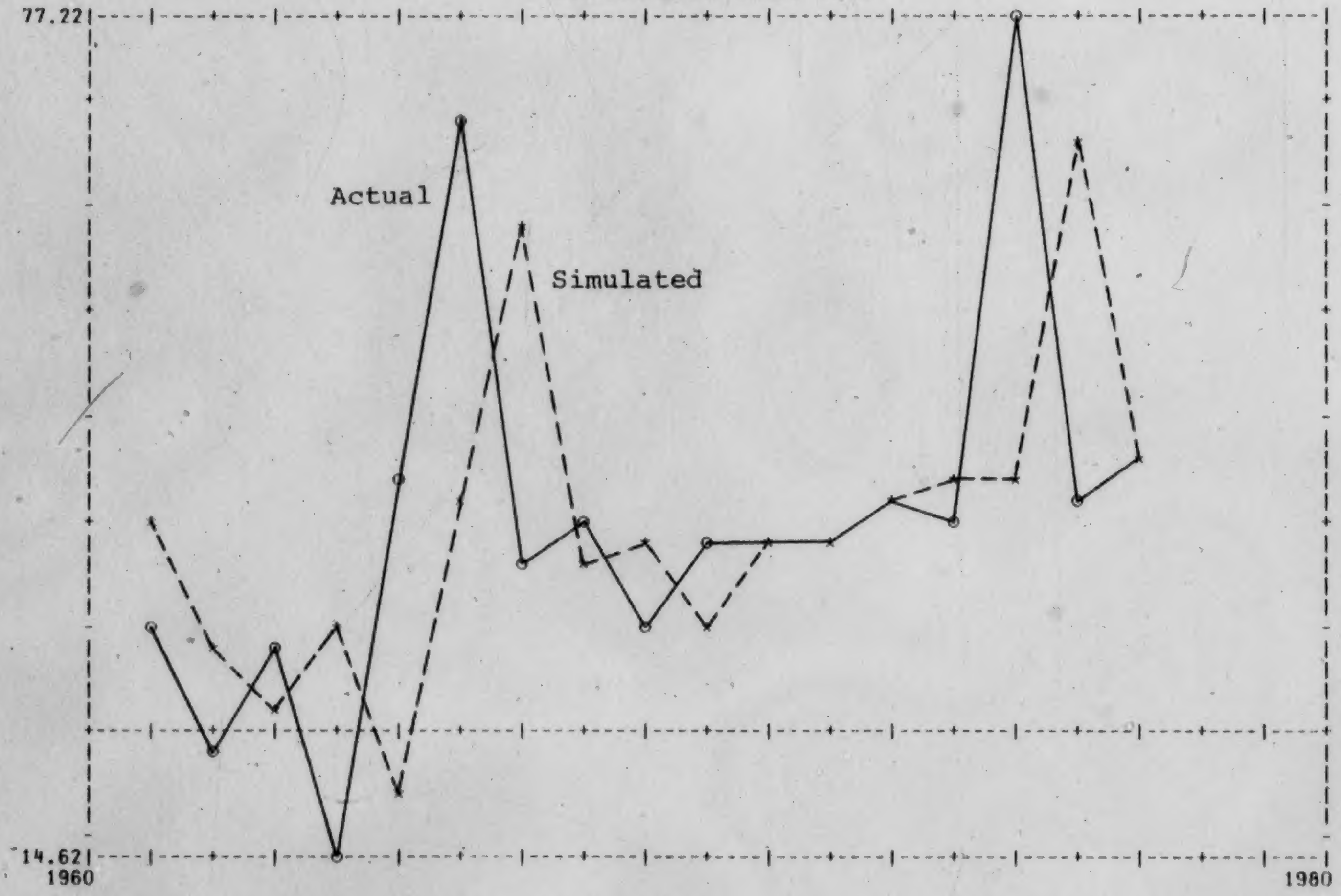

Figure AIII-25

Simulation III: $\dot{BP}/BP$

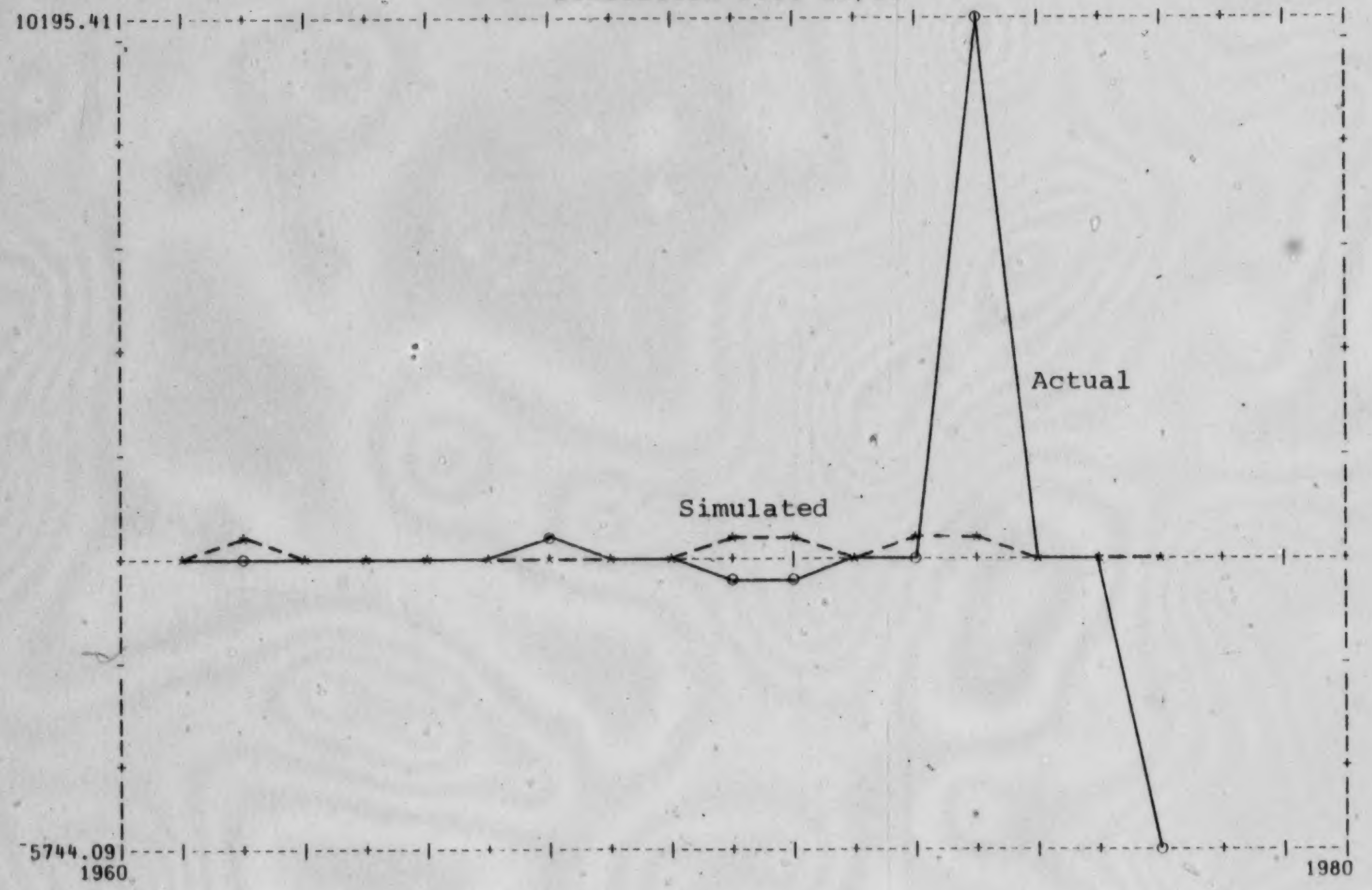

Figure AIII-26

Simulation III: $\dot{Z}/Z$

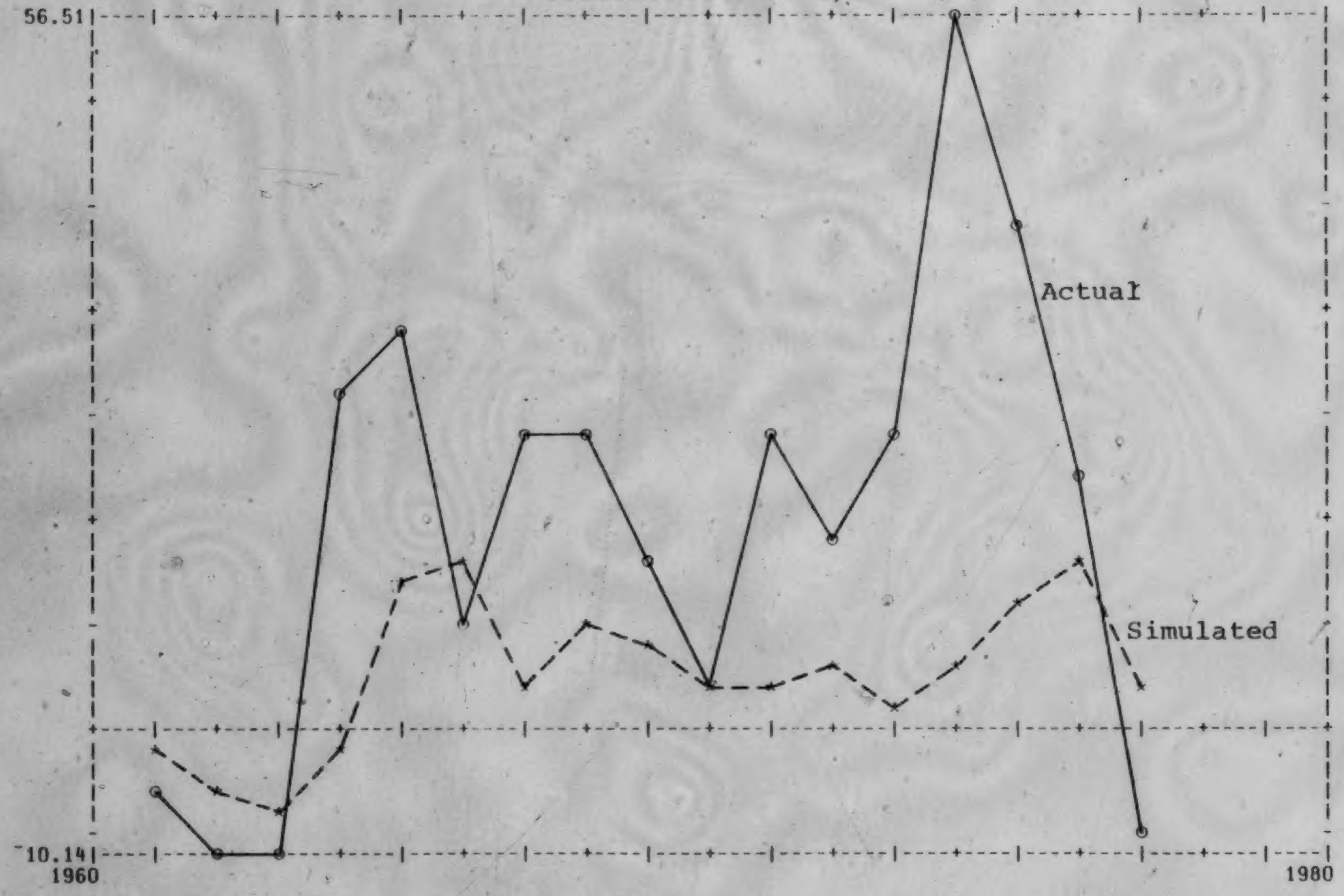

Figure AIII-27

Simulation IV: $\dot{F}/F$

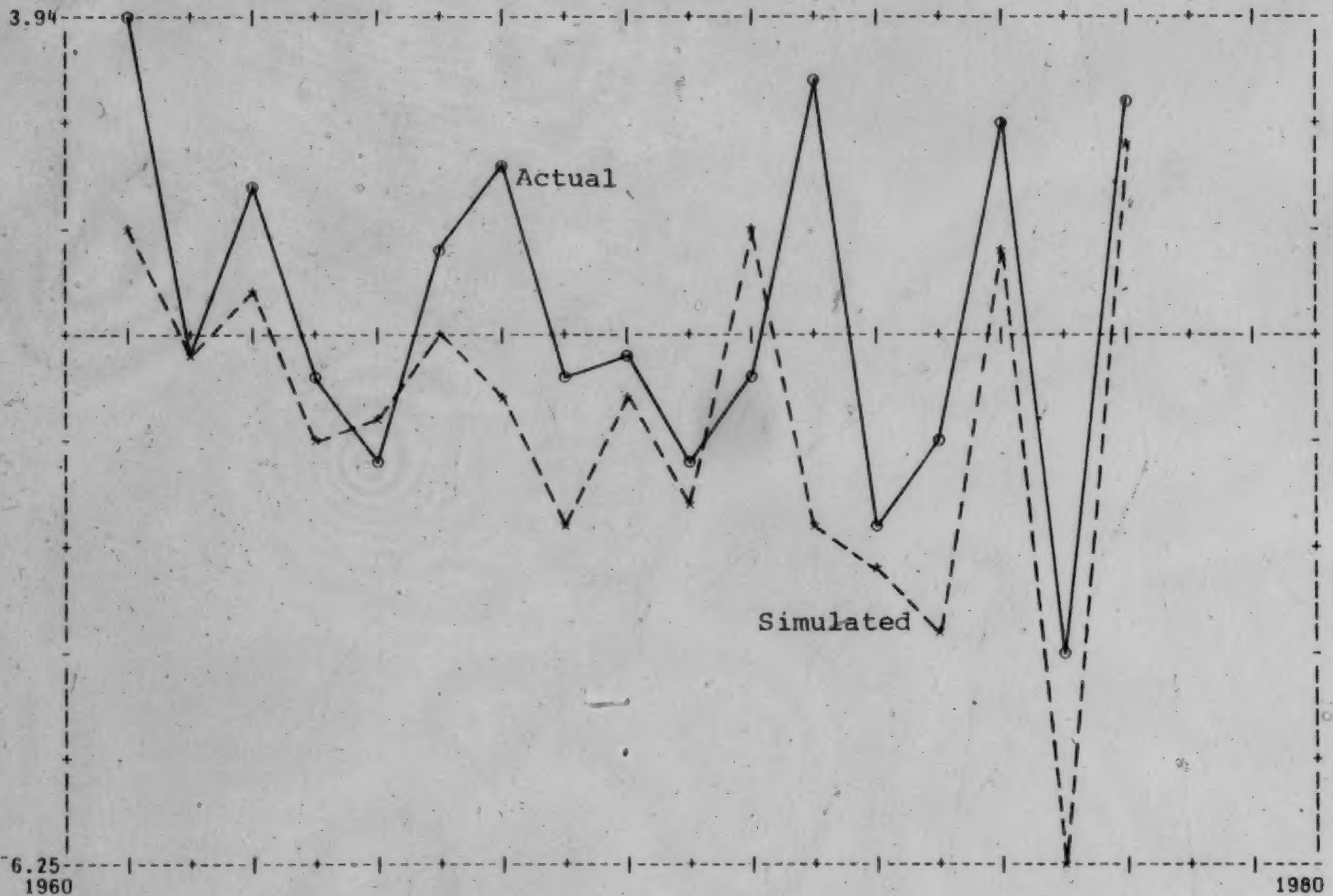

Figure AIII-28

Simulation IV: $\dot{P}a/Pa$

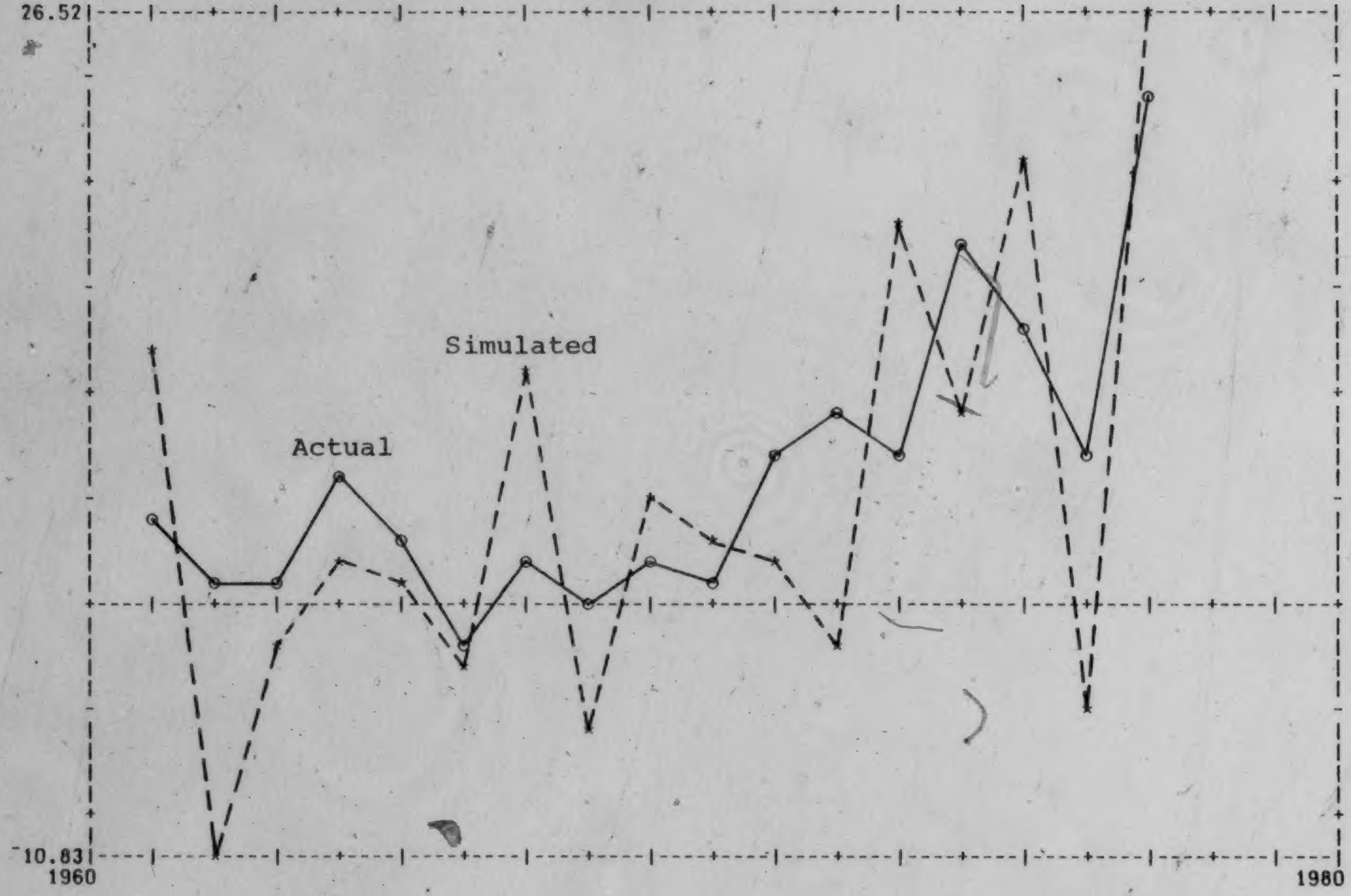

Figure AIII-29

Simulation IV: $\dot{P}i/Pi$

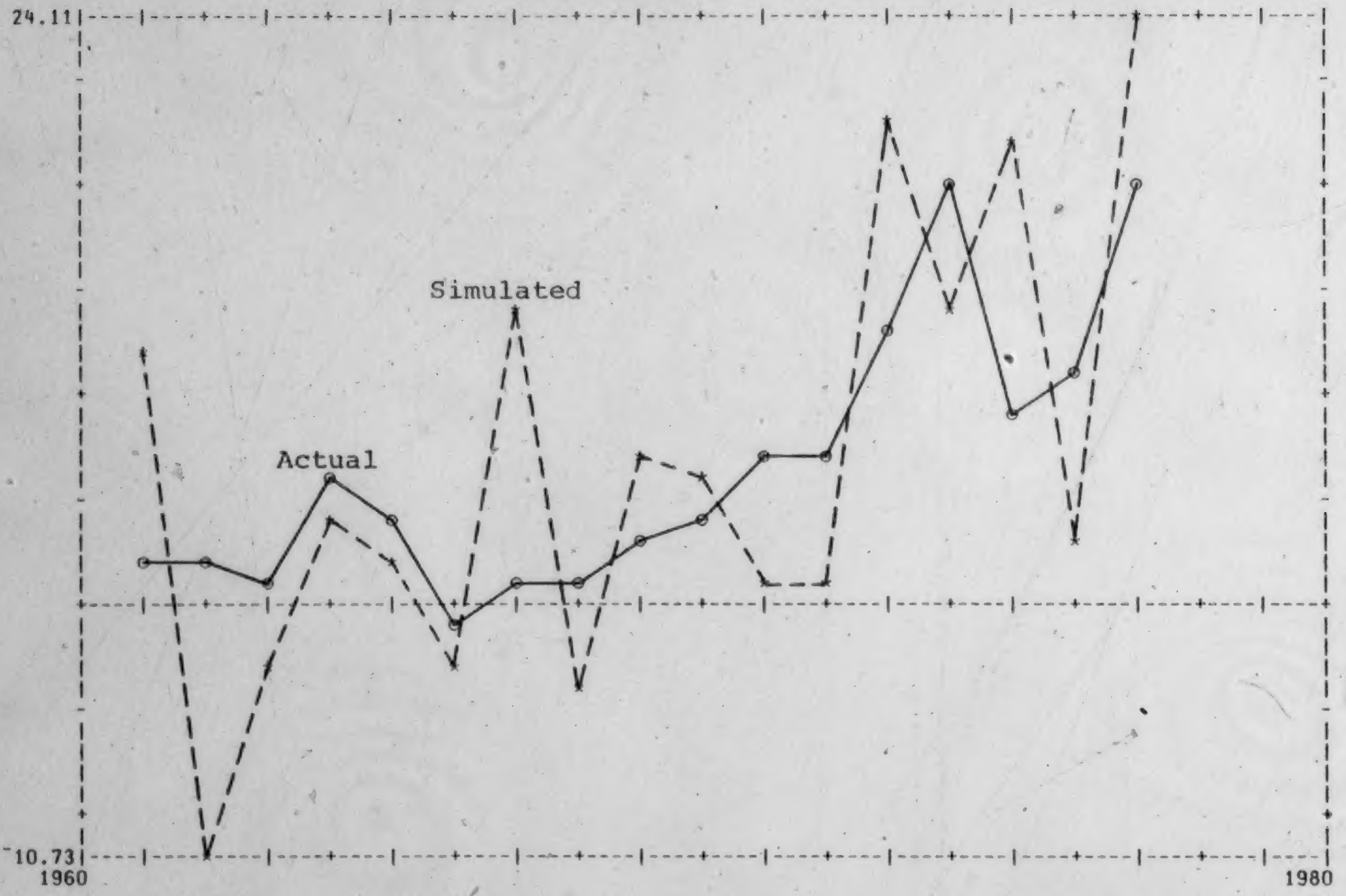

Figure AIII-30

Simulation IV: $\dot{P}/P$

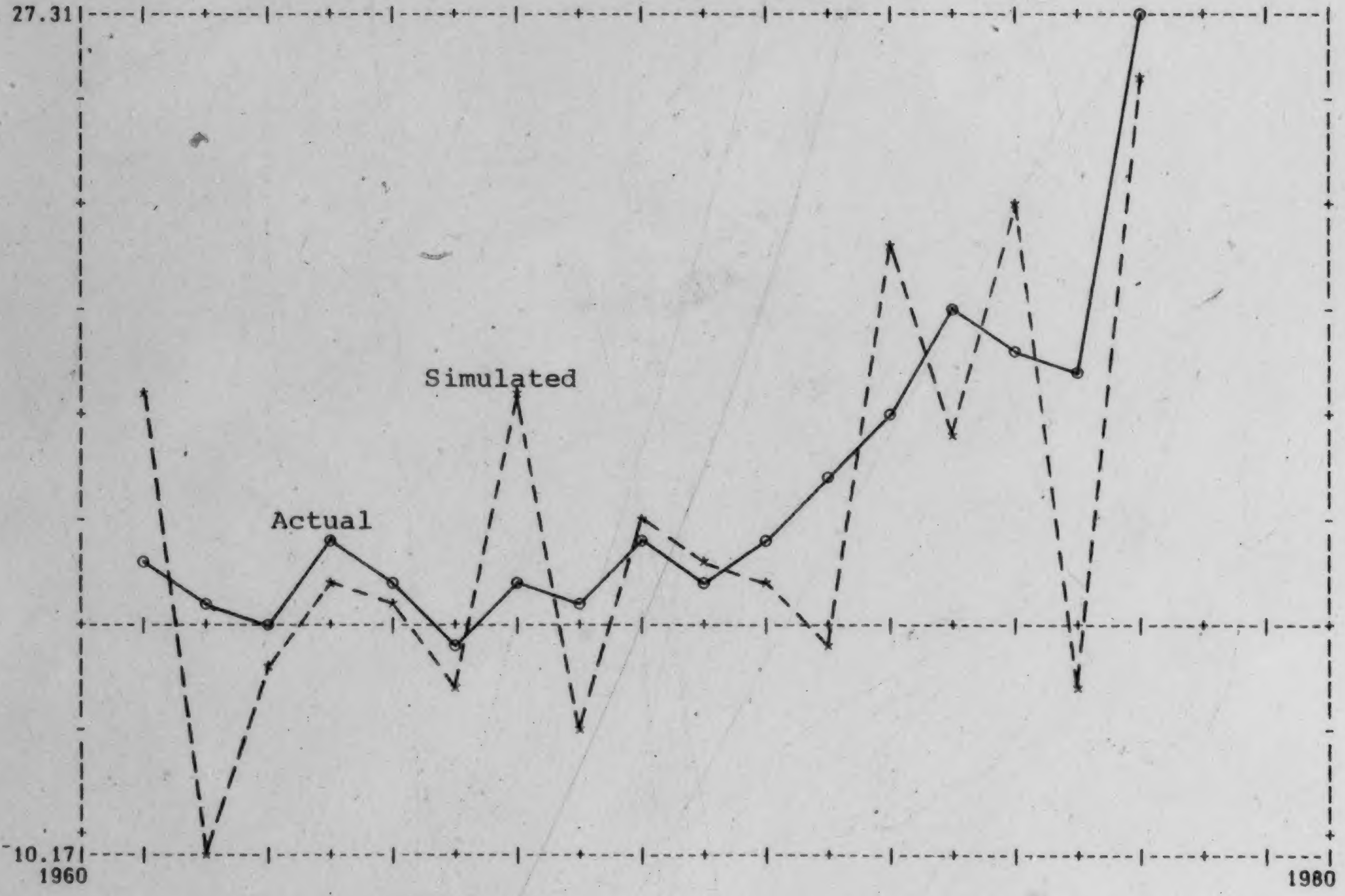

Figure AIII-31

Simulation IV: $\dot{W}/W$

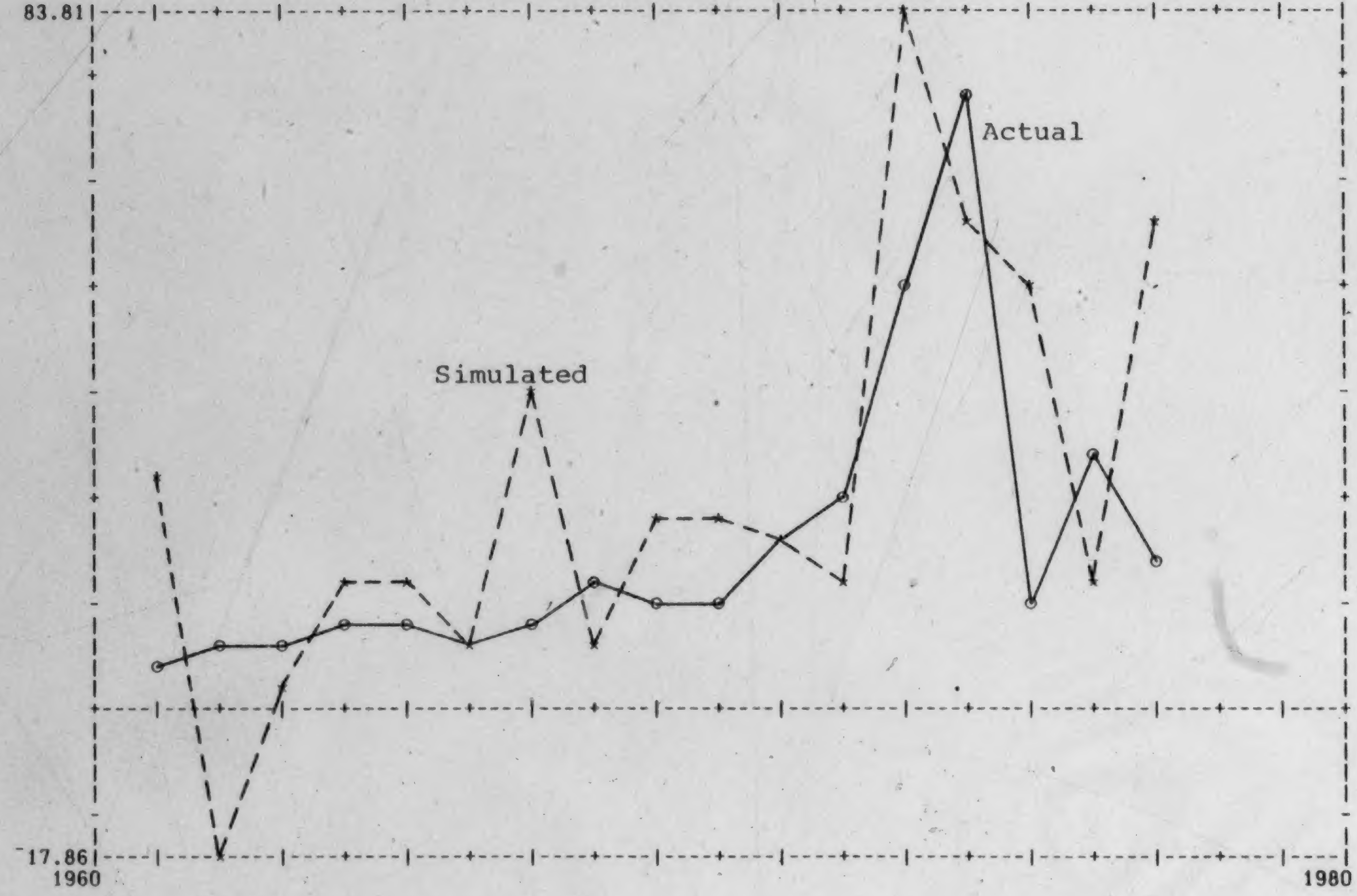

Figure AIII-32

Simulation IV: U

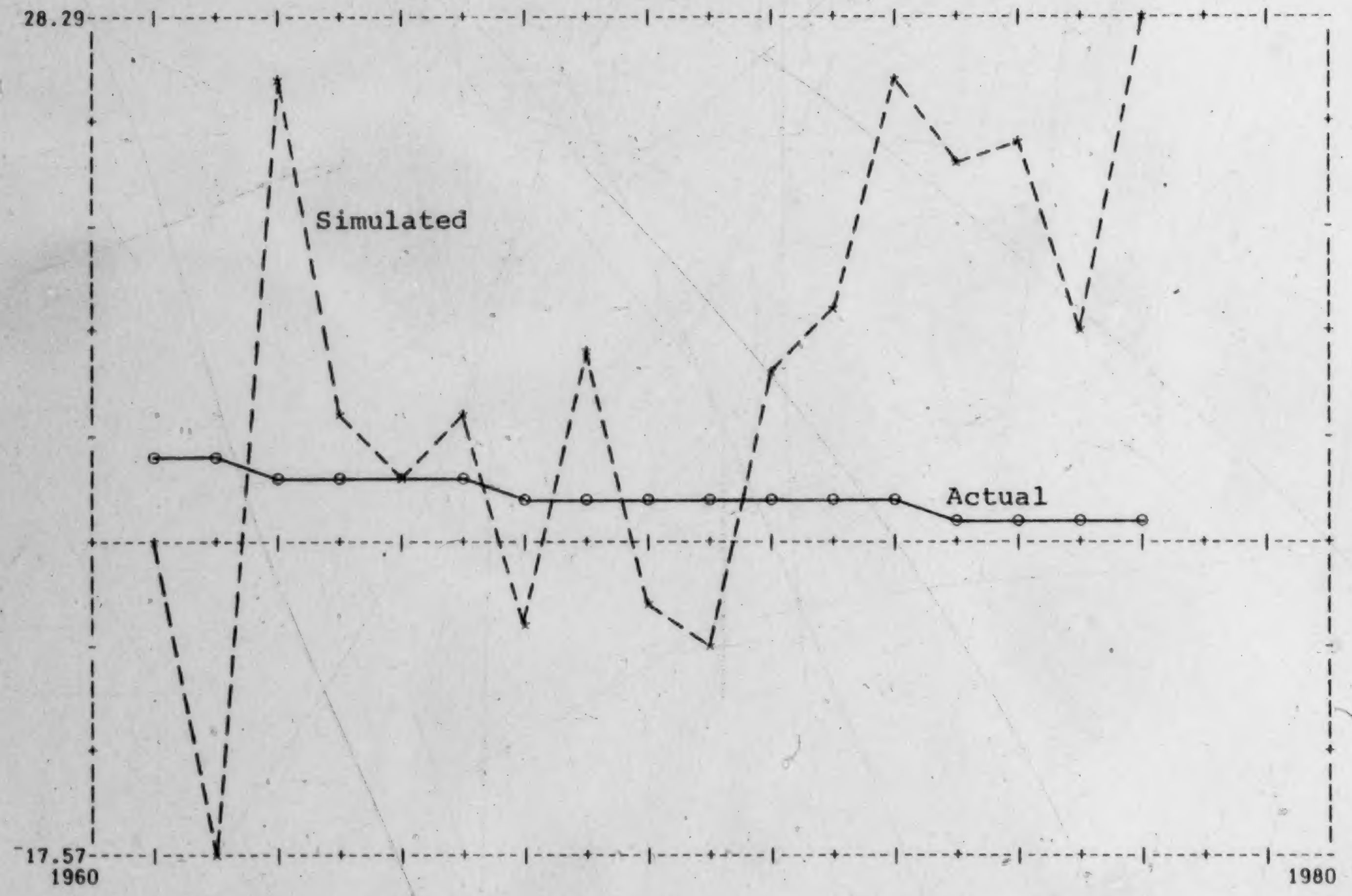

Figure AIII-33

Simulation IV: $\dot{Y}/Y$

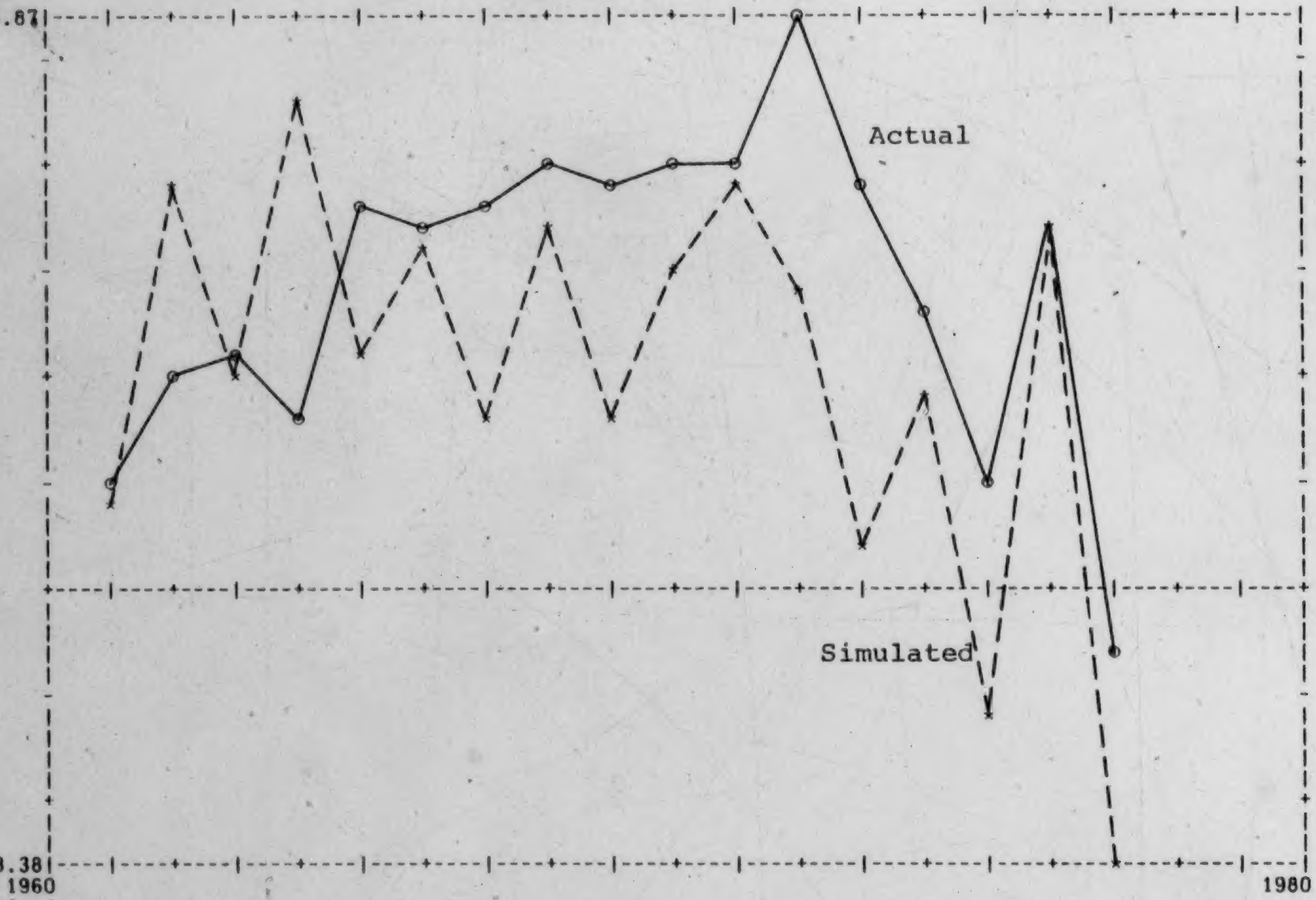

Figure AIII-34

Simulation IV: $\dot{M}/M$

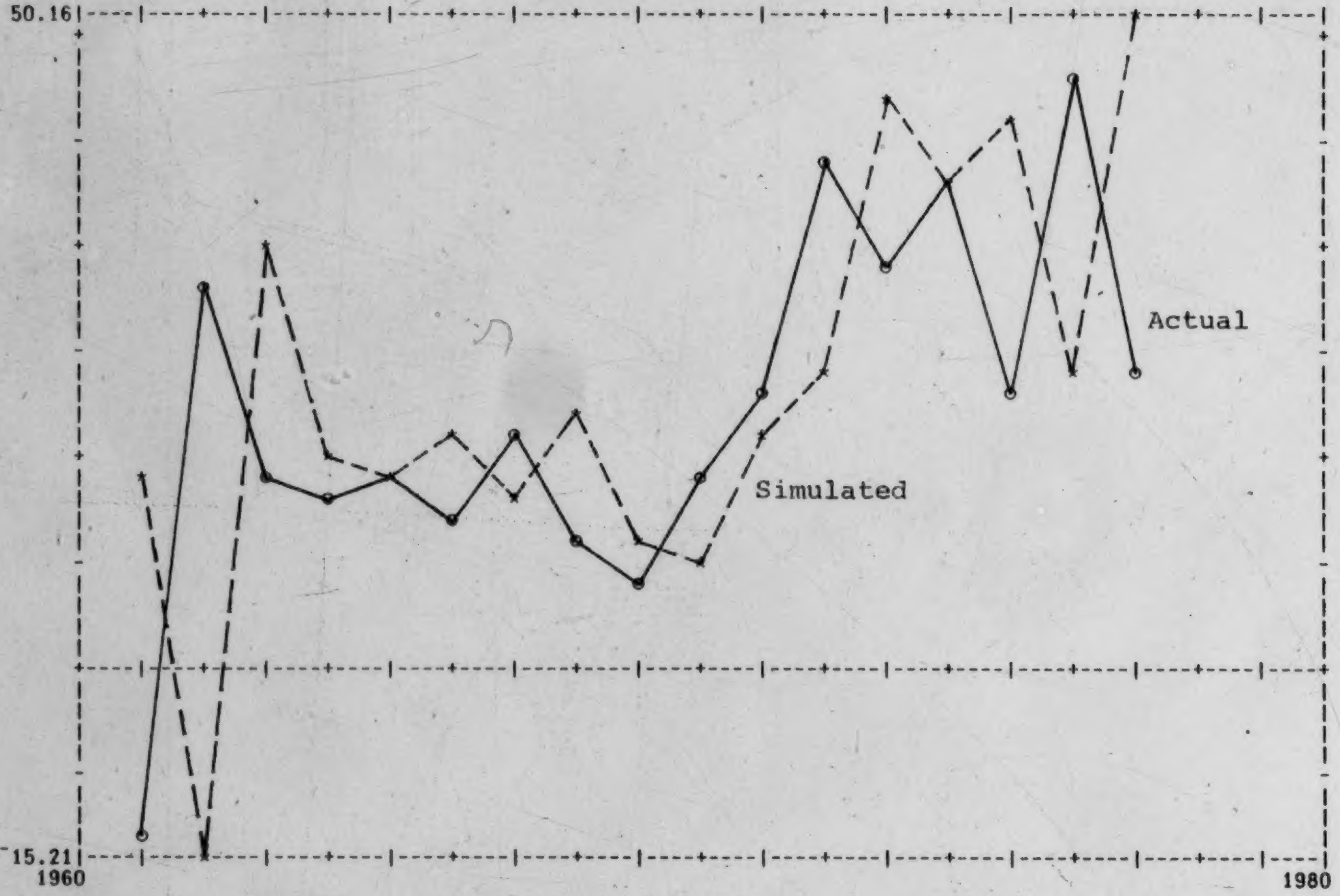

Figure AIII-35

Simulation IV: $\dot{D}/D$

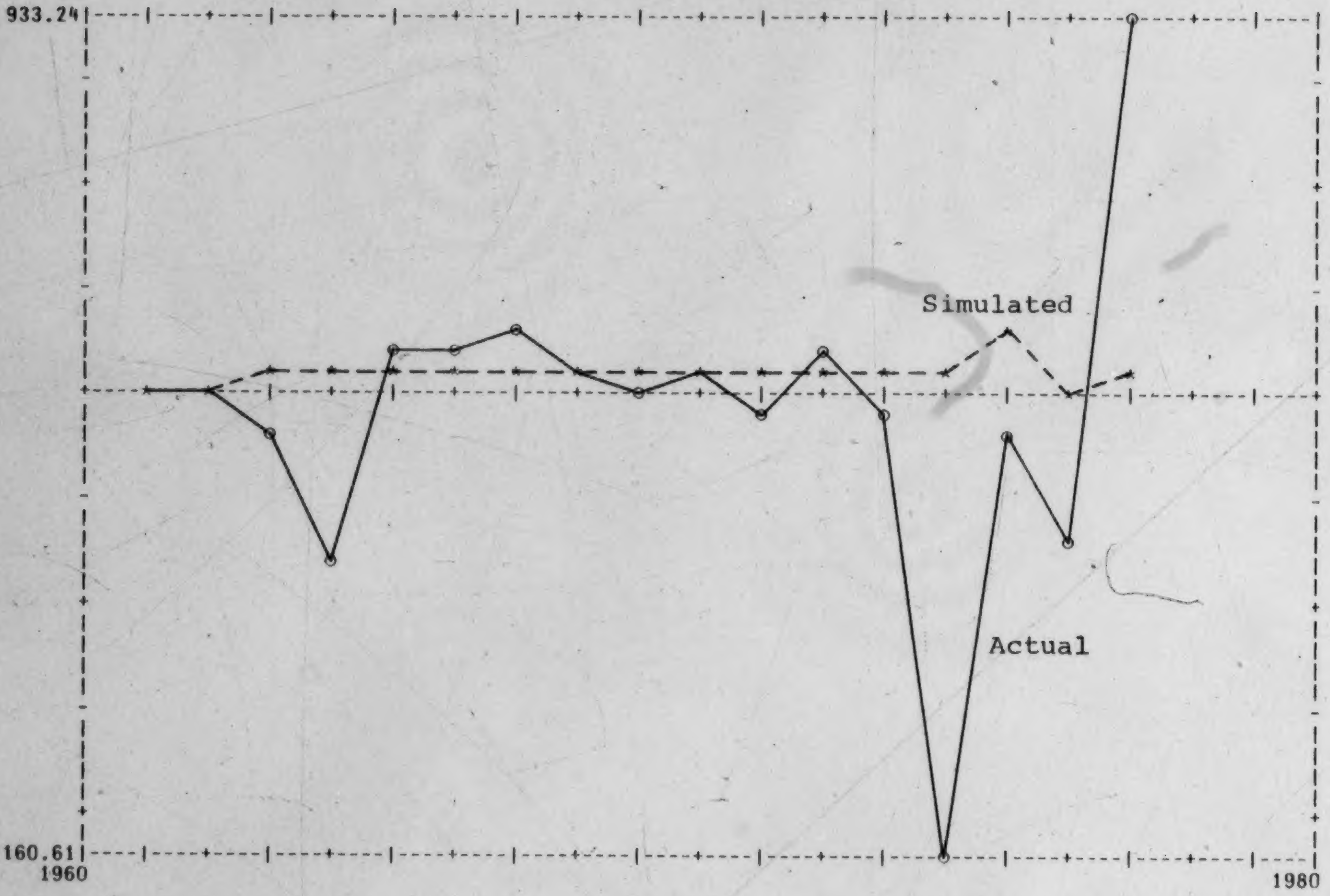

Figure AIII-36

Simulation IV: $\dot{G}/G$

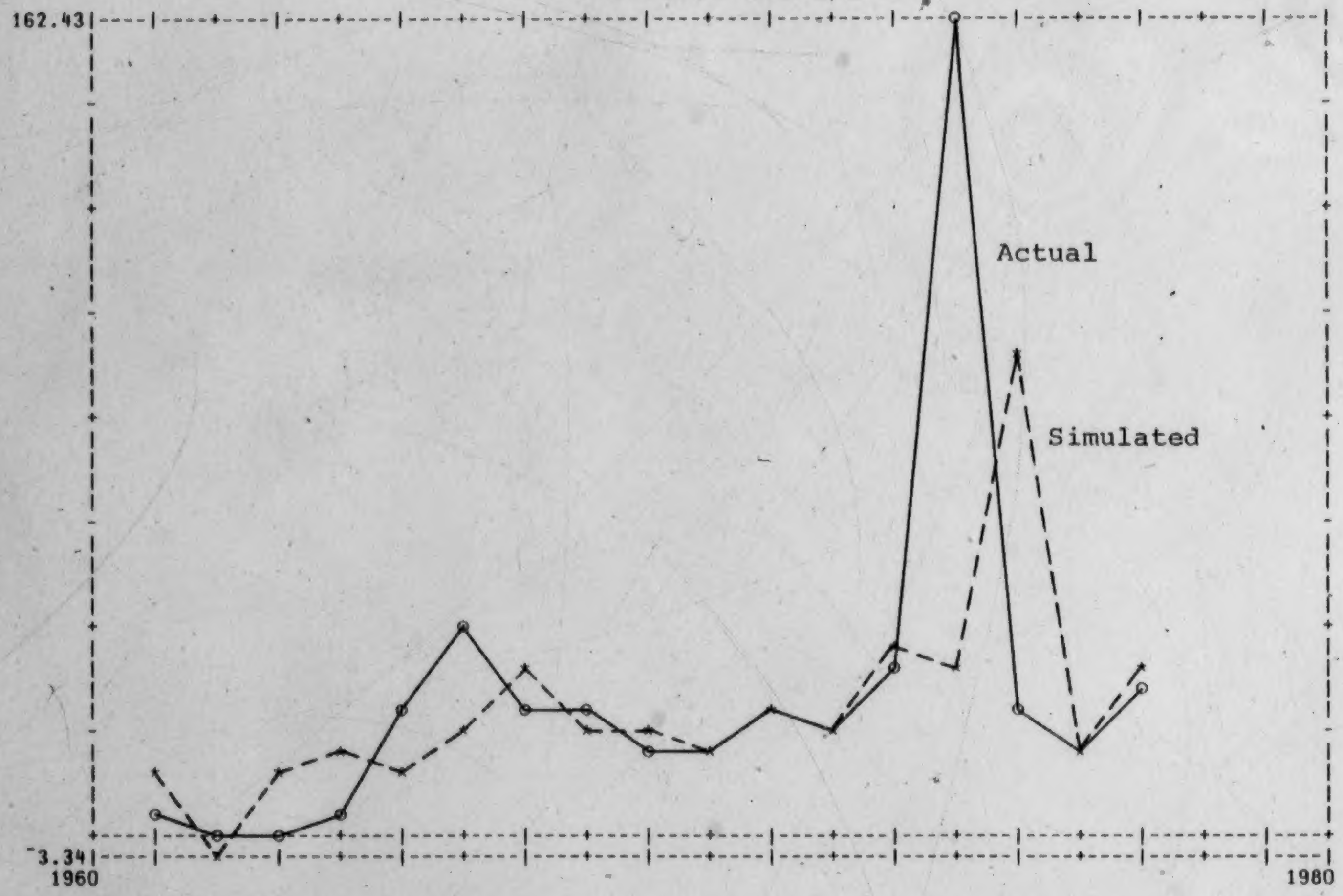

Figure AIII-37

Simulation IV: $\dot{R}/R$

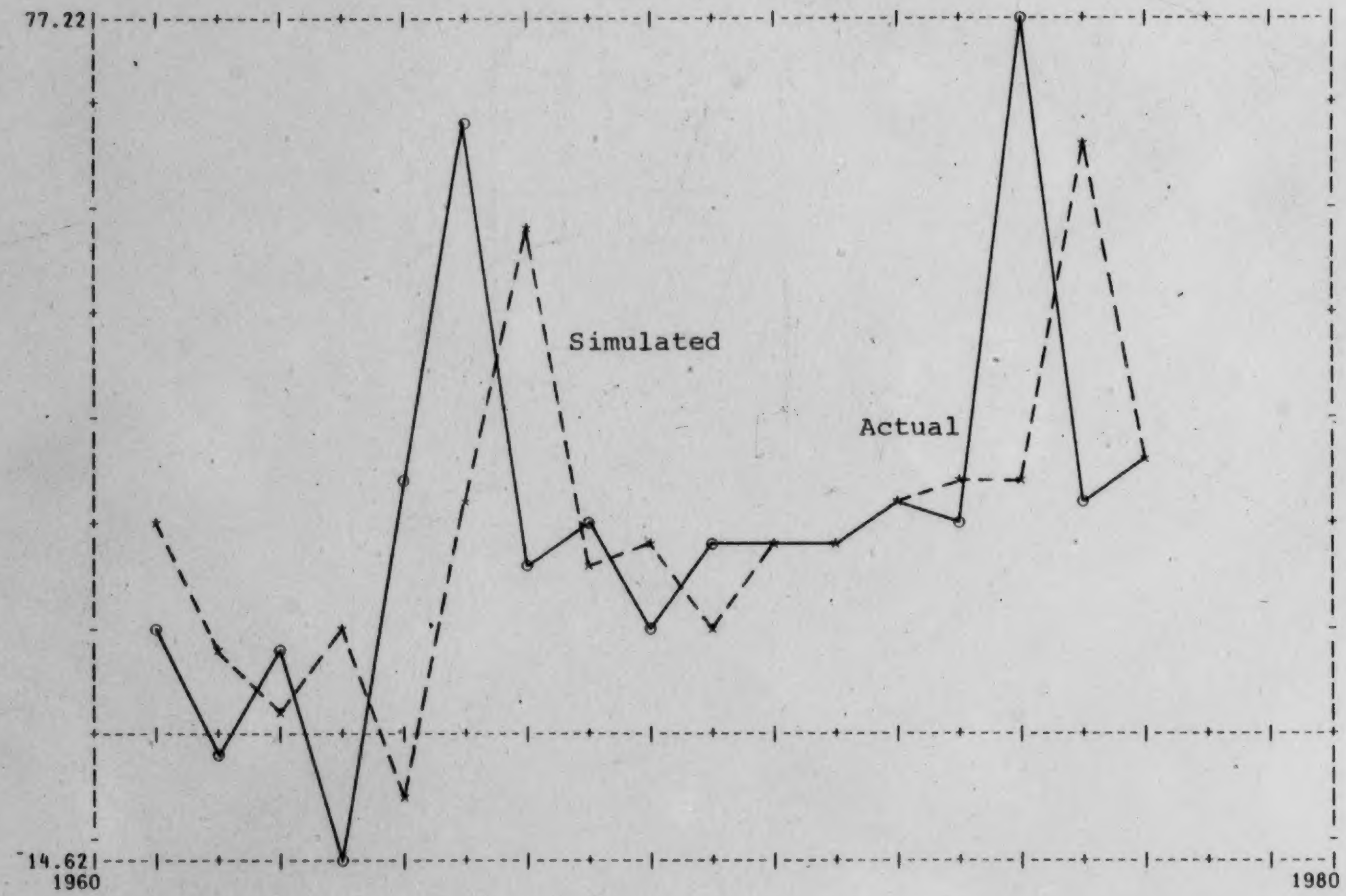

Figure AIII-38

Simulation IV: $\dot{B}P/BP$

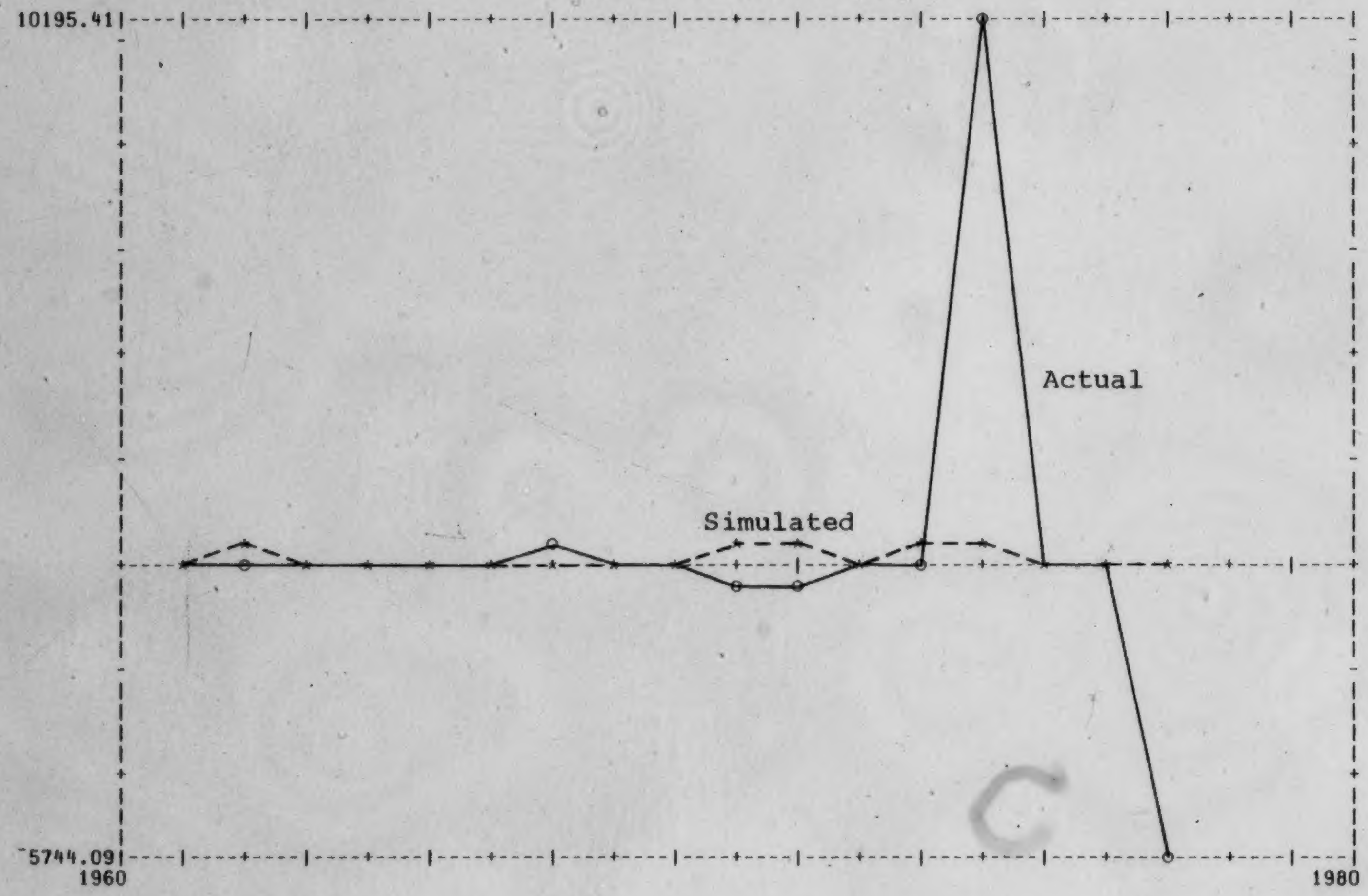

Figure AIII-39

Simulation IV: $\dot{Z}/Z$